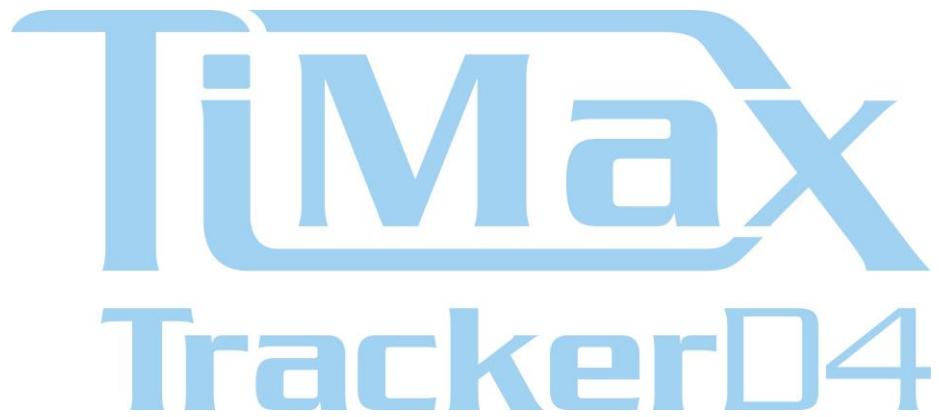




TiMax Tracker D4

Installation & Operation

01-02-26

Referenced Software Versions:

Ubisense: 3.8.9319

Tracker Translate: 2.3.4.4

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System Overview

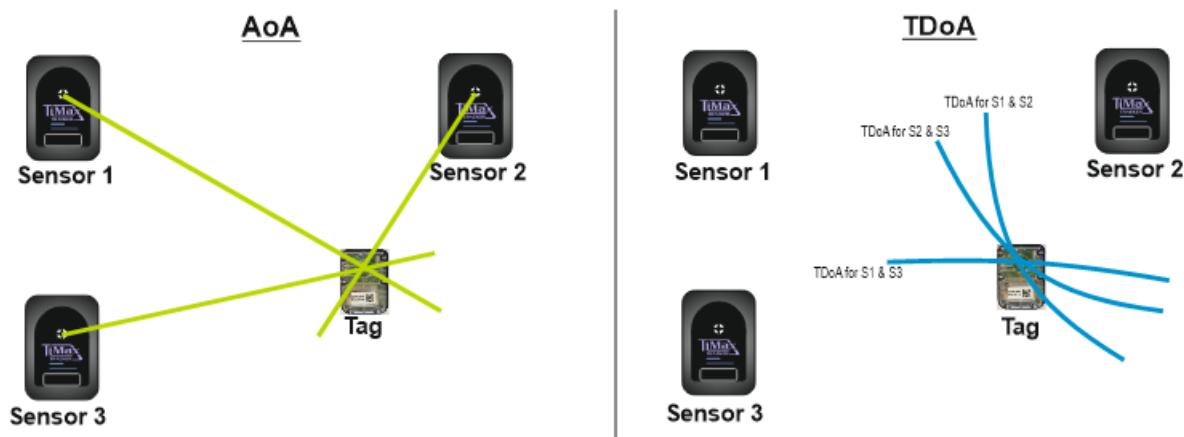
How it works

Each TTd4 Tag transmits a continuous stream of very short low energy radio frequency data packets containing its ID.

The packets are detected by the TTd4 Sensors which measure the Angle of Arrival (AoA) at each sensor and the Time Difference of Arrival (TDoA) between each pair of sensors.

The Location Engine software is able to calculate the location of the tag by applying the measured angles and times to a virtual geometric model of the space using the known sensor positions and calibrated interconnection cable lengths.

The unique combinations of tracking technologies allow a tag to be located accurately in 3D when seen by only two sensors, this compares favourably with TDoA only tracking systems where typically 5 sensors must see a tag for a 3D location and yields much more robust tracking than AoA only based technologies which are highly susceptible to errors due to multi-path reflections.



Location using Angle of Arrival (AoA)

Sensors are equipped with an internal multiple antenna array that allows each sensor to measure the angle on incidence of the radio frequency pulse transmitted by the tag.

The software contains a geometric model of the space and so from the reported angles of arrival at the sensors, the software can determine the position of the tag.

Location using Time Difference of Arrival (TDoA)

All the sensors are synchronised to a highly accurate clock signal allowing the software to measure the Time Difference of Arrival between each pair of sensors of the radio frequency pulse transmitted by the tag.

The software contains a geometric model of the space and from the reported time differences can determine the position of the tag by working out where the TDoA curves intersect.

Tags

TTd4 Tags are supplied factory programmed with their update rate and while active will continue to transmit location pulses. Tags are activated and de-activated using a magnet. Tags will run for several months (depends on update rate) and indicate low battery status when the battery is discharged by around 90%.

Computer

The TiMax TrackerD4 Location Engine Server PC can be supplied in laptop or rackmount format - the general specification includes an i7 processor, 8GB ram and at least one Network Interface for connection to the sensors.

The PC if supplied by TiMax Spatial is comes complete with software installed and fully configured.

Software Overview

The TTd4 software installation includes a number of apps for various tasks - the most frequently used apps are listed below with a brief explanation of purpose.



Platform Control is where Platform Services required for tracking to operate are started and stopped.

Set directory path for active dataset.

Platform Services can be set to AutoStart on bootup.

Platform Services MUST be running for the tracking system to work.



Location System Configuration (LSC) is used to set up the tracking system, configure sensors, calibrate the system, log and review tracking performance.

LSC does not need to be running for the tracking system to work.



Service Manager is used primarily to install a dataset built on another computer as well as providing a visualisation of the status of services required for tracking to run.

Service Manager does not need to be running for the tracking system to work.



Tracker Translate converts the raw incoming tracking data to OSC, PosiStageNet and other protocols, also provides the operator with a performance overview. The app also provides tag naming, backup and override as well as filtering and anti jitter functions.

Tracker Translate MUST be running for the tracking system to work.

Considerations for best performance

At least 2 sensors must see the tag to make a location and if more sensors see the tag from different points of view the accuracy will be enhanced further.

Ensure that the area to be tracked is covered by sensors from the front, behind and at the sides, it is very important that the tag is seen from as many points of view as possible for accurate location.

Be careful to mount sensors in positions where they have an unobscured view of the tracked area (stage) and there are no RF reflective surfaces in the near field of the sensors vision.

The RF pulse transmitted by the tag is very high frequency and low energy and will not pass through a human body.

Ensure the tag is worn by the performer in a position to ensure best all round visibility to the sensors from all points of view.

Best tag positions are in hats and wigs. Tags mounted at the nape of the neck or in-between shoulder blades are also a good positions. The usual position is in a pouch on the radio belt. Try to find places where the tag is most visible from the widest possible angle and minimally shadowed by the wearers anatomy, i.e. arms.

Costume material can also have an effect on tracking performance - metallic thread and sequins can have a detrimental effect.

Study set construction and materials and choose sensor locations to minimise possible attenuation or multipath reflections caused by metallic or foil surfaces that may reflect radio frequency signals.

Software Installation and Configuration

Overview

- Install three Ubisense applications; Platform Control, Service Manager and Application Manager
- License the Ubisense software to the PC.
- Launch the software in Standalone Mode to open the generic dataset included in the installation software package and deploy the services on the PC using Service Manager
- Set up Location System Configuration using Application Manager
- Configure logging and set tracking data stream forwarding address to Tracker Translate
- Set up the PC network port IP address and edit Windows Registry if multiple NICs
- Add sensors to the dataset
- Configure Sensor Timing
- Install or configure a DHCP server on the system
- Add background image (optional)

Installing Ubisense applications.

1. Unzip the installation folder
2. Navigate to Servers
3. Install UbisenseServers.msi
4. Navigate to Clients
5. Install UbisenseApplicationManager.msi
6. Install UbisenseServiceManager.msi

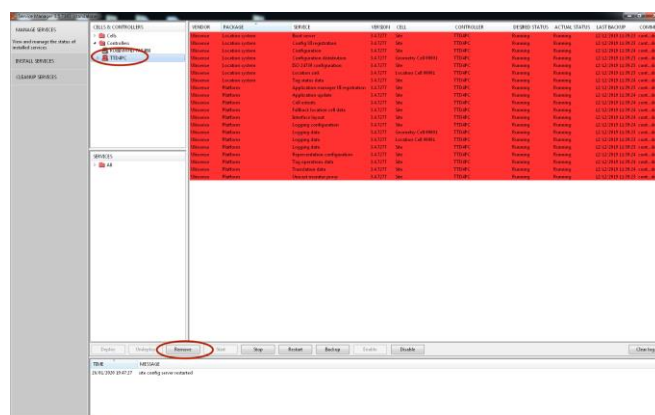
License Instructions

1. Run Platform Control application from Start Menu or Ubisense Folder and get license Host ID
2. Open this link in browser <http://download.ubisense.net:8889/>
3. Enter License Reference: **a0B7R00001SYjdyUAD**
4. Enter Host ID – this is automatically copied to the PC clipboard when Platform Control is run.
5. Click Request license
6. After a short time a link to Download license will appear
7. Install License: - unzip the license file and run

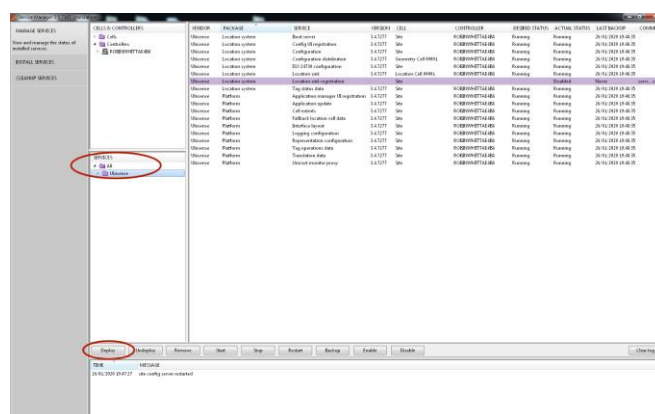
8. Close Platform Control

Install the TTd4 Dataset

1. Unzip the TTD4 Default Dataset
2. Open Platform Control
3. Browse to TT d4 Default Dataset, when selected you should see “OK Exists”
4. Check the box to run in standalone mode
5. Start the Services that aren’t already running, click apply
6. Start Service Manager
7. Click Undeploy
8. Expand Controllers in the Cells and Controllers window and remove the old controller.



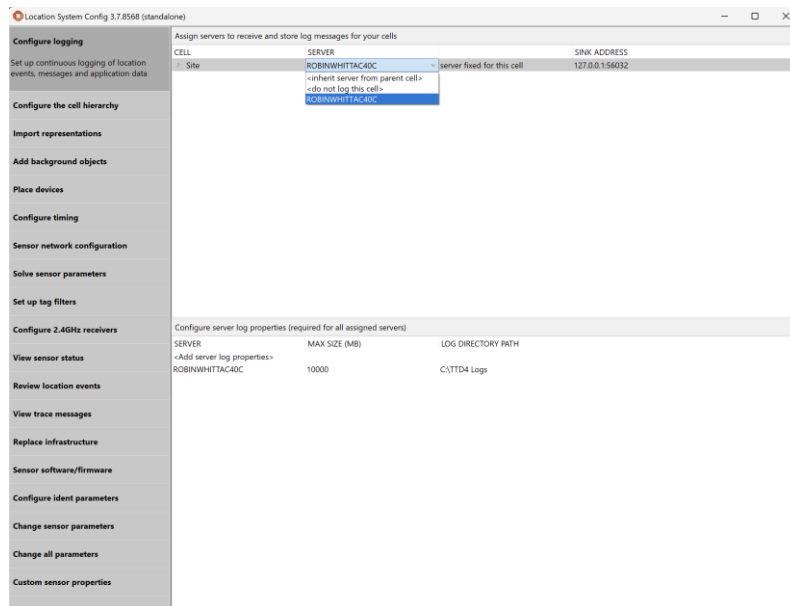
9. Select the red controller icon in top left window and click Remove or hit Delete
10. Start services running on the new PC (controller)
11. Click on All in the Services window and click Deploy to run services on new controller



Services should all show Running status as in the screenshot above.

Setup Location System Configuration

1. Run Application Manager
2. Select Location System Configuration and click Create Shortcut



3. Location System Configuration should now appear in the Windows Start Menu
4. Start Location System Configuration

Configure Logging

1. Using Windows File Explorer, create a folder on the PC called TTD4Logs
2. In Location System Configuration select Configure Logging and in the lower window double click <add server log properties> .
3. In Choose a server select the PC and under Log Directory Path double click to navigate to that folder and save
In the upper window double click the Server entry and select the Tracker PC and make sure that the server attribute is set to “server fixed for this cell” as indicated in the screenshot above.

After a few seconds the Sink Address will automatically set and IP address and Port

Network and DHCP server configuration

1. Set PC to fixed IP address e.g. 10.133.0.1 or 192.168.1.1
2. Set the PC subnet to 255.255.255.0
3. Open ini/config file, change IPPPOOL_1 to the range you want, e.g. 192.168.1.11-20
4. Set the DHCP server subnet to 255.255.255.0
5. Scroll to bottom of ini file and delete existing MAC/IP addresses

***** Important*****

the PC and DHCP subnet mask MUST be the same or the sensors will not boot

Running D4 with multiple NICs

To ensure d4 binds to the correct NIC, set a platform_interface registry key.

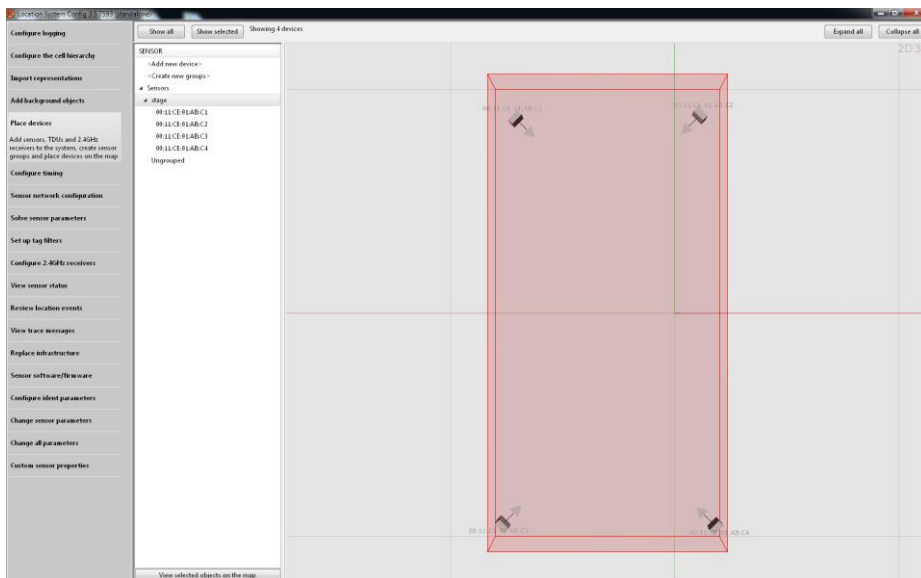
To do this:

1. Stop the platform
2. Run regedit and go to
3. **Computer\HKEY_LOCAL_MACHINE\SOFTWARE\WOW6432Node\Ubisense 2.1\Platform\Config**
4. Make a new string value platform_interface
5. Set it to your NIC address
6. Start the platform

Place Devices

Select place devices window using the tab on left of the screen.

Delete sensors from the default dataset , under sensors and stage, and then delete from ungrouped.



Add new sensors by double clicking <Add new device>

OR

Start DHCP Server

Wait for all IP's to be served

Open ini file check all sensors in the list

Copy list to a text file, delete everything apart from the desired sensor MAC addresses

Edit replace brackets and – with nothing to delete them

Copy and paste into add new device list and save

Drag from un-positioned into box on right side

This moved them to ungrouped

Select and Drag onto Stage

Make sure the stage is a representative size, to edit double click stage in list.

Newly added sensors will be listed in a folder >**Unpositioned** and can be dragged into the map, or placed by double clicking on the sensor and adding x,y,z coordinates.

Refer to the Calibration section for instructions on obtaining sensor x,y,z coordinates.

Make sure that the sensors are contained by the Geometry Cell, the Location Engine Cell.. these extents can be viewed by clicking **Show view options** and selecting **Show cell extents** and are set in **Configure cell hierarchy** tab.

Setup and Edit a Sensor Group

To determine which sensors are used to locate tags within a boundary, create a sensor group (Stage).

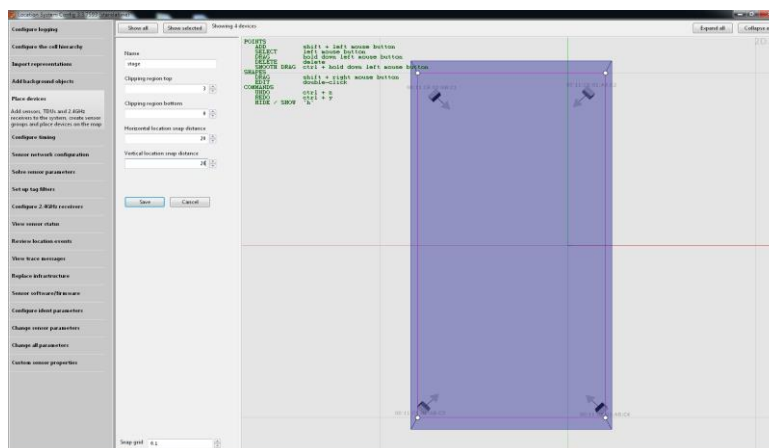
Add sensors to sensor group by dragging sensors into the group in the left hand window in the Place Devices tab.

Draw the extents of the sensor group boundary in the right hand window.

Edit the Sensor Group attributes by double clicking on the group 'Stage' to open the editor, as shown below.

Set the Horizontal and Vertical Location Snap Distance to a large number like 20m and tracking will be constrained to the Stage area.

This tells the software that any tag seen within 20m of the 'Stage' boundary will be kept within the boundary, tis will also apply to any mis-tracked tags.



Configure Timing

Set the designated master sensor to be Timing Source

This sensor **MUST** be connected to Master on the d4 Timing Hub

Set the other sensors to Receive From Ethernet

Import Graphic File

Import a graphic file (optional), scale and set zero - refer to Ubisense Location System Config Manual for details

Add Background

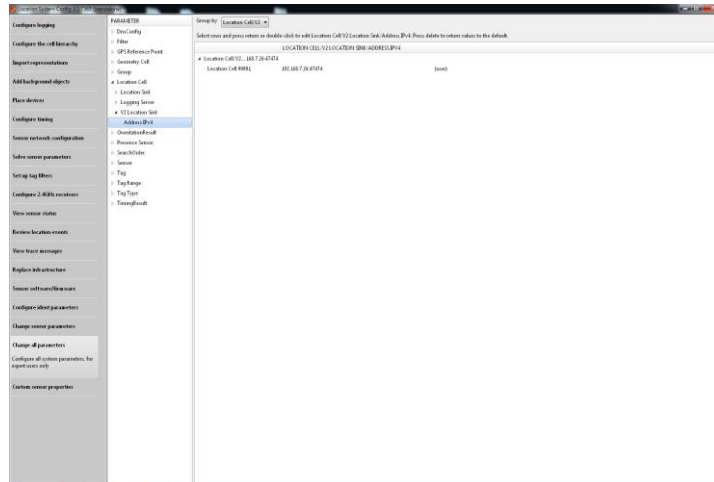
Place the graphic file (optional), in order to Add Background the image must first be imported and scaled.

Direct the Tracking data stream to Tracker Translate

Open Location System Config

Click on the tab Change All Parameters, expand Location Cell, expand V2 Location Sink, select Address IPV4

Set IPV4 sink address to the Tracker Translate host PC IP 127.0.0.1 and port 47474

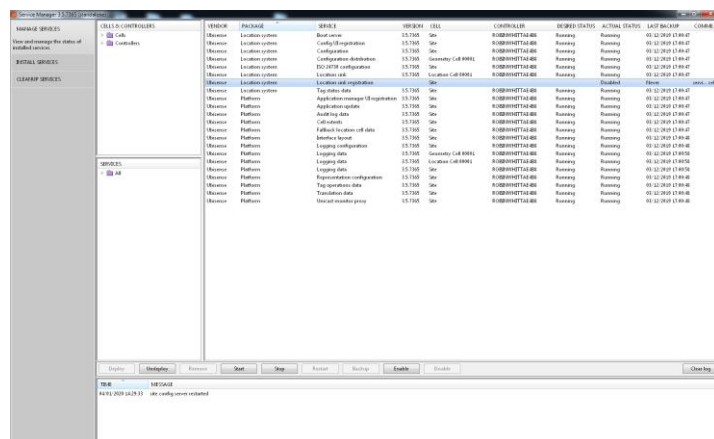


127.0.0.1 is local loopback if TT is on same PC, if TT is on another PC use that IP

Showing how to set data stream destination

To prevent the IPV4 Sink address being reset:

1. Open Service Manager
2. Select the service Location Sink Registration
3. Click on the Disable button at the bottom of the window



Showing how to disable Location Sink Registration service

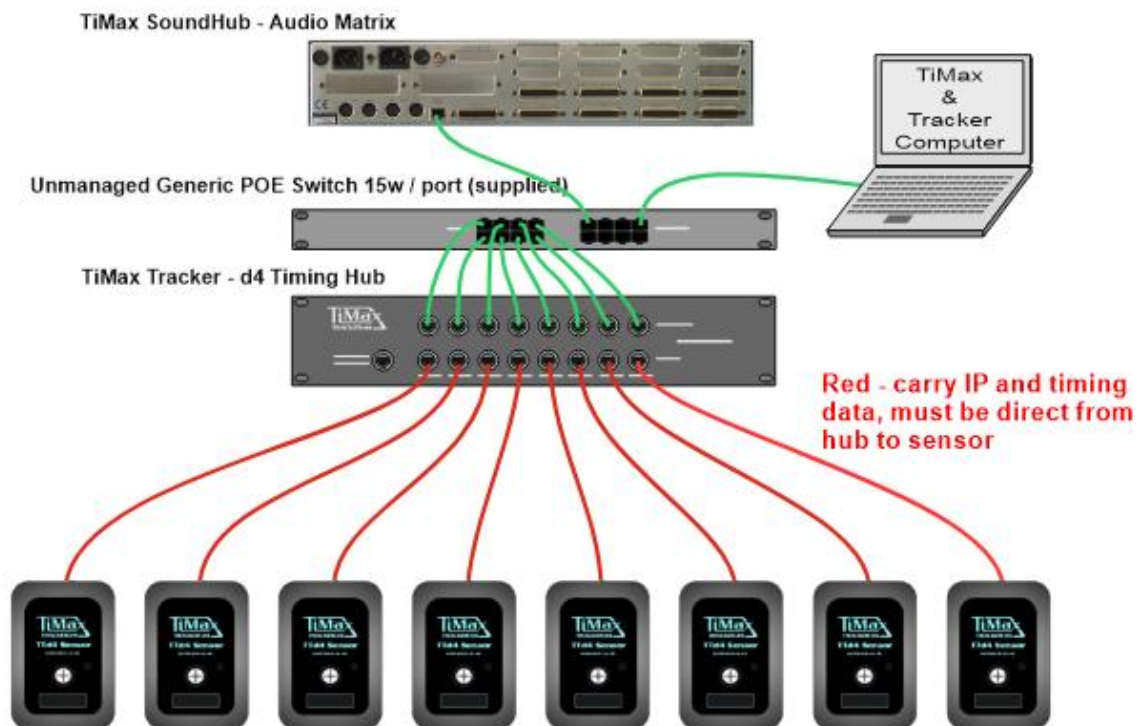
Setup Hardware

Connect Sensors, Hub and PC

Best Practice

Sensors, Hub and TiMax Tracker PC are connected on an isolated network of minimum complexity.

Other networks including control and internet should be connected to the Tracker PC via a second Network Interface Card (NIC).



Tracker Sensors are connected to the Timing Hub with shielded Cat5e (or better) cables - for outdoor use it is recommended to use Ethercon connectors. Maximum length 100m.

The Timing Hub is a passive hub for interconnection of timing signals between sensors carried on spare cores of the Cat5 cable.

The Timing Link connector on the Hub is used to interconnect the timing signal to a second hub for a 16 sensor system.

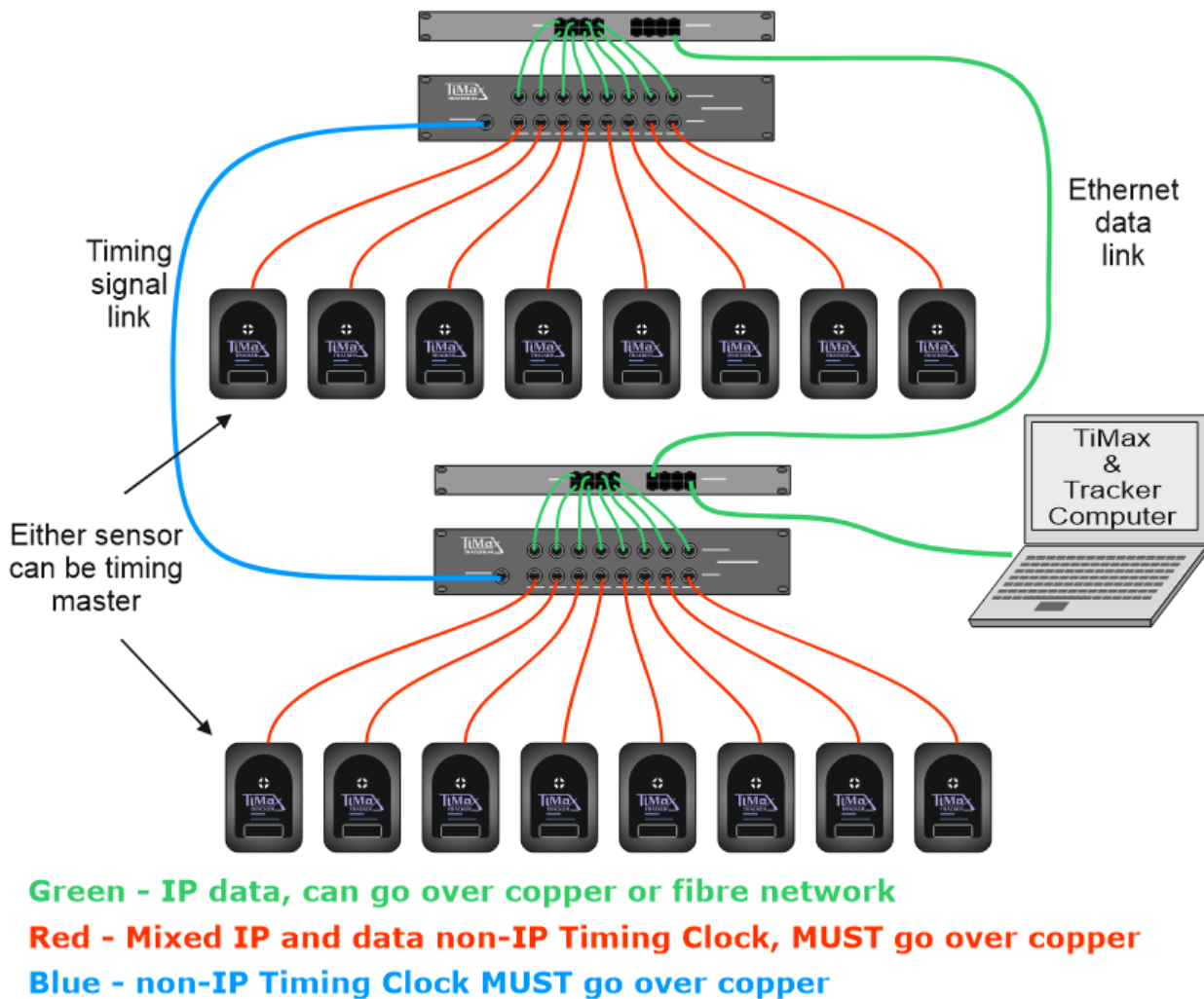
Sensors are POE powered and require around 10w per sensor.

Short patch cables from each POE port to the Hub provide IP data communications and power for the sensors, these lines are directly connected through the Hub from the POE port to the sensor port

One sensor is designated Timing Master in software, this sensor **MUST** be connected to the Master sensor port.

Slave sensors may be connected in any order but once the system is calibrated this order should not be changed

Larger Systems with 2 (or more) Hubs



The diagram above shows a typical 16 sensor system interconnection.

Dual hub setup with linked timing

The master sensor must be configured to transmit the timing signal on the Ethernet connector.

Set the timing configuration as follows:

In the Location System Configuration app:

1. Navigate to the Sensor > Physical > Timing > Allow Ethernet Output parameter.
The parameter has the following values:
False: the sensor is configured for timing input only on the Ethernet port.
True: the sensor is configured to send timing output on the Ethernet port, if it does not receive timing from this port.
2. Double-click Allow Ethernet Output and set the parameter as required:
To configure the sensor for both timing input and output, select the check box.
To configure the sensor for timing input only, clear the check box.
3. Click Save.

Interconnection using Fiber Optical Networks

Installations on large sites can use Fibre networks for transport of the IP data signals

These connections are indicated in yellow on the drawing below.

Connections in red and blue are mixed IP and Timing information and **MUST** be direct connections on copper.

If it is not possible to link the Timing signal between 2 hubs, each group of sensors can run on its own local Timing synchronisation, this is achieved by defining a Timing Master for each Hub.

In this case, each group of sensors will be able to resolve location using both TDoA and AoA and in coverage areas where sensors from both groups see the tag, the sensors will be able resolve location using AoA data shared between the sensor groups.

First time System Startup

After initial software installation and configuration of the PC and environment and full system hookup including hub and sensors, the full system should be ready for first time start up.

1. Shut down tracking services in Platform Control so they show Not Running
2. Power up the tracking system network switch and make sure power is getting to the sensors and that Sensor data LEDs are flickering.
3. In Platform Control, check the Run in Standalone Mode and restart the services, make sure that they all show Running status.
4. Open Service Manager and check that all the services are running.
5. Start the DHCP server and check that it is awarding IP addresses in the correct range to the sensors.
6. Open Location System Configuration and in the View Sensor Status window make sure all the sensors are running.

Note that the first full system boot up can take several minutes.

Common Issues

Platform Services do not start

- the most common reason is that the tracking system software does not see the network when the Platform Services boot.
Make sure that the switch is connected to the PC NIC.
Make sure that the switch is powered and booted up before starting the Platform Services.
- If multiple NICs are installed on the PC, make sure that the tracking system software is correctly bound to the NIC connected to the sensor switch and the IP address is correctly set.

Sensors do not boot

- make sure that the DHCP server is running and awarding IP addresses to the sensors.
- check the PC firewall settings, the Ubisense software must be allowed
- check the status LED on the sensors, these will indicate the boot up stage and any issues, as detailed the Boot Process section of this guide.

Setting Sensors to Fixed IP address

In order to set sensors to fixed IP addresses or change sensor IP address settings, the sensors must be connected to the system and up and running. If previously un-set, the sensors must be started up on a DHCP server.

1. Boot the sensors with IP addresses obtained from a DHCP server. It is recommended to set the DHCP server to award addresses in the same range and values as the intended fixed IP addresses.
2. In LSC go to the Sensor Network Configuration page, set the sensors to the same IP addresses as the DHCP server has awarded.
Be sure to set the Subnet Mask to the same as the computer... usually 255.255.255.0 If the subnet mask for the computer and sensors are not the same, the sensors will not boot.
It is not necessary to set the Default Gateway.
3. Go to the View Sensor Status page and select all the sensors and reboot.
The sensors will reboot twice, once from DHCP and then from fixed IP address.

For confirmation that the process is complete, go to the Sensor Network Configuration page and check that all the sensors are in the Custom Valid list.

BE SURE TO MAKE A LIST OF IP ADDRESSES SET, OR MARK UP THE SENSORS WITH THE IP ADDRESS!

Un-setting sensor fixed IP address

Option 1 – if the IP address is known.

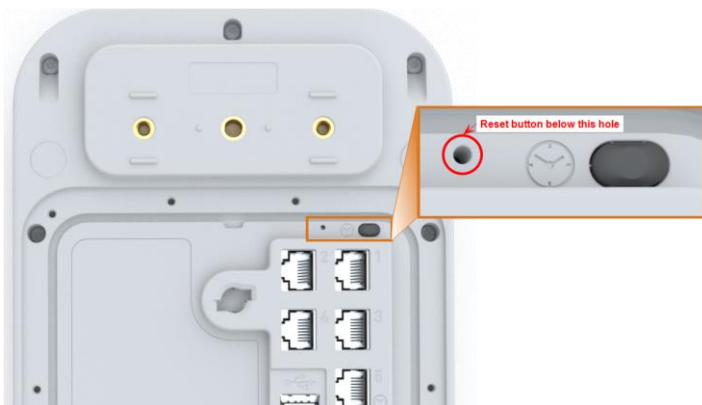
1. Boot the sensor and in LEC go to the the Sensor Network Configuration page
2. One by one select each sensor and clear out the fixed IP address and Subnet Mask.
3. Set up the DHCP server to award IP addresses in the same range as the previously fixed IP addresses.
4. Reboot the sensors

To confirm successful reversion to DHCP, in the Sensor Network Configuration page check that all sensors are listed in the Default list.

Option 2 – if the previously set IP address is unknown

1. Remove the rear cover from the sensor (the back box covering the connectors)
2. Identify the small hole above the top block of RJ45 connectors and find a paperclip or similar actuator that fits in the hole.
3. Insert the actuator into the hole and feel for the recessed switch behind the hole.
4. While depressing the switch, plug the sensor into the hub and continue holding down the switch for 5 seconds.

If successful, the sensor should reset to default DHCP mode and will boot if there is a DHCP server running and everything else is set up correctly.



Change sensor IP address

To change the sensor from one fixed IP address to another, first unset the fixed IP address, then boot from DHCP and follow the process described above to set the sensors to a fixed IP address.

System Calibration

Overview

Sensor coordinates must be known in order to calibrate the system. The more accurate the measurements, the better the tracking performance.

The sensor coordinates (x,y,z) must be entered into the Location System Configuration software to calibrate the system.

There are 3 principle means to determine sensor positions, this is a necessary part of the setup prior to calibration.

Direct measurement

From a single point where all the sensors can be seen using a Totalstation or Leica Disto D910 - these all in one measurement devices combine laser distance measurements with inclinometer and rotational measurements and trigonometry calculator. They are quick and accurate but expensive.

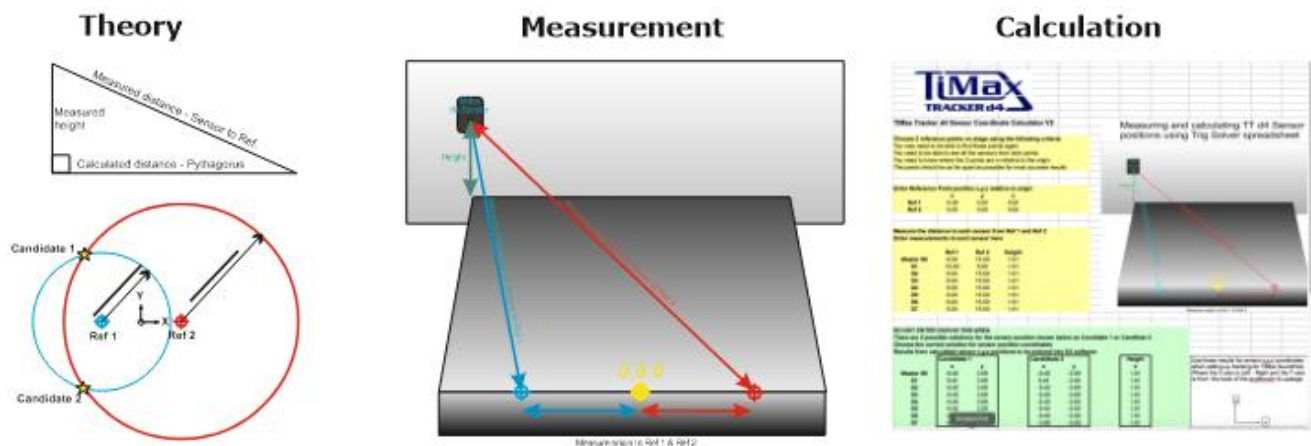
Indirect measurement

Using a simple laser measurement instrument and calculation in a spreadsheet, we have done the work for you and detailed the principle and methodology below. TrigSolver-V2 spreadsheet download here: <https://spaces.hightail.com/space/3k560K1n8K>

Measuring and calculating Ttd4 Sensor positions using Trig Solver spreadsheet

Calculate the position of a sensor within an x,y,z coordinate system by measuring the sensor height and distance from 2 known positions.

Measure and calculate the horizontal distance of a sensor from two known points. Project circles of those radii onto the horizontal plane and calculate the intersection points of the circles. Choose the candidate answer that corresponds to sensor position.



Recommended process:

- Choose two reference points on the stage on a known axis with a known relationship to the origin (0,0,0) point.
- All the sensors to be surveyed should be visible from both the reference points.

- In the example illustrated above, the two points are chosen on the front edge of the stage and the origin of the coordinate system is chosen as the centre of this line.
- Reference points should be as far apart as possible for best accuracy but still visible to all the sensors to be surveyed.
- Enter the positions of Ref 1 and Ref 2 into the spreadsheet.
- Measure from Ref 1 and Ref 2 to each sensor in turn and enter these distances into the spreadsheet.
- Measure the height of each sensor and enter these into the spreadsheet.
- The spreadsheet will calculate the x and y positions of the sensors from the measured distances by solving a simultaneous trigonometrical equation and display 2 sets of results one set in each of the Candidate 1 and 2 sections of the spreadsheet.
- The 2 sets of results are mirrored about the plane on which the 2 reference points are located.
- Use your skill and judgement to determine which is the real result and use that one when entering the data into the d4 Location Engine Configuration software.... be aware that sensors close to the mirror line can be difficult to assess as Candidate 1 and Candidate 2 can be very close together.

Off plan measurement

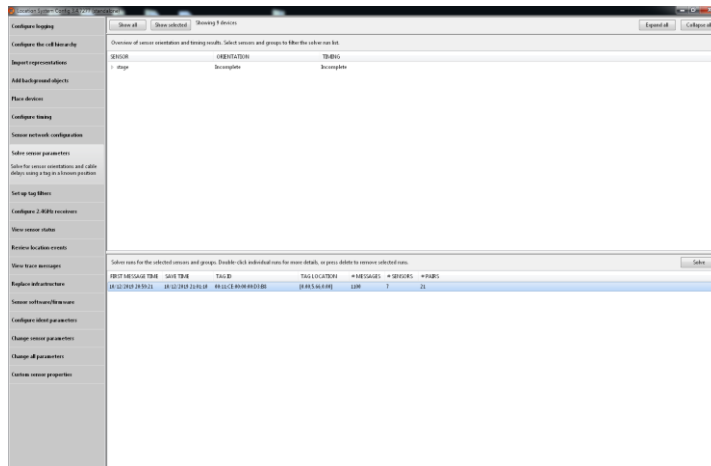
If you have detailed and know-to-be-accurate site plans, this is also an option however BEWARE, plans are often less accurate than they claim to be.

Calibration

TiMax TrackerD4 calibration measures and records pitch and yaw values for the Sensors, and timing offsets for the TDoA reference in the Sensor cabling.

Calibration process:

1. In Location System Configuration, in the Place Devices tab, set the x,y,z coordinates of each sensor.
2. Go to the Solve Sensor Parameters tab, if there is a previous calibration select it in the lower window and click Delete
3. Hit the Solve button, it opens a small window offering you to enter tag ID and location information.
4. Place a TTd4 Tag at a reference point on stage.
Select any tag and make a note of its ID, place it at a known measured position on stage (eg, 0,0,0) Click Solve, enter tag ID in the Solve and position and click Start
5. Choose all or some of Sensors to be calibrated
6. After a few seconds a list of Sensors will appear in the lower left window, tick (if tick box is present) to select the Sensors to be calibrated.
First pass you should click all of them, but you can go back and check and recalibrate individual sensors if they get moved or you need to pick a different reference point on-stage for the reference Tag (see below).
7. After a few seconds a list of azimuth and timing parameters will appear in the lower middle and right hand windows tick to select any or all Sensors to be calibrated.
Wait for around 1000 readings.
8. If all good click Save and Close.



Common Calibration Issues and solutions.

Not all sensors have clear line of sight to the calibration point.

- The system will support multiple calibration runs using different tag positions.

During the calibration process some sensors are showing higher STANDARD ERRORS

- Look for reasons; could be poor line of site to the calibration point or strong multi-path reflections.
- To remedy, try a different calibration points on stage where eg upstage sensors might get a better view of the tag.
- Try calibrating with the tag raised up off the floor / stage deck, floor materials may be causing strange effects.

TIP - Avoid reflective surfaces near the Tag, or people walking round stage during calibration.

Review Location Events

To aid system setup and optimisation as well as to help us help you to spot and diagnose tracking issues, this guide explains how to monitor live events and how to extract past events that have been logged by the system.

To review past events:

1. On the Review location events tab, if necessary click Clear.
2. Click Get events.
3. Enter the maximum number of events to retrieve.
4. Select the Use last or Enter timespan options.
5. Click Retrieve Messages.
6. after all the location events within the time span are retrieved, the button changes back to Get events.
7. Review the events that have been retrieved.

To view the location of tags in real time:

1. Go to the Review location events tab.
2. Click Get events.
3. Select the Listen in real time option.

4. Select the Location Cell.
5. Click Start listening.
6. Monitor events as they occur.
7. When you have finished, click Stop listening.

To filter location events that you have retrieved whether real-time or historical:

1. Click Get events.
2. In the Times section, select Filter messages that have already been retrieved.
3. In the Filters section, enter a Tag ID.
4. Click Filter Messages. You can now review the filtered messages.

To review retrieved location events:

1. Click in the time line area at the bottom of the screen.
2. Scroll through events using the horizontal scroll bar or the Left or Right Arrow keys.
3. Look for issues on an event by event basis and note the event number .. this is very useful when reporting problems.
4. Check power received is similar

Fine tuning tracking performance

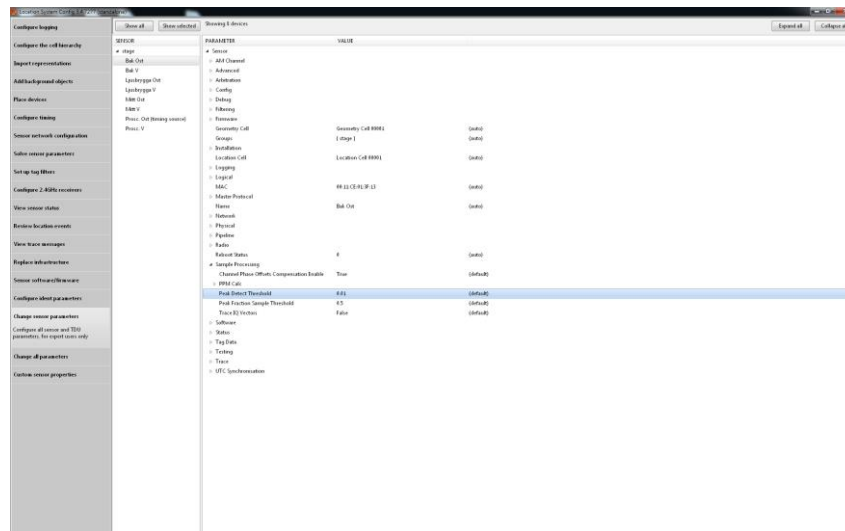
Once the tracking system is up and running with a good calibration, there are some things worth looking at that may improve tracking performance.

Increase sensor sensitivity

In cases where some sensors are distant from the tracked area it is an option to increase the sensitivity of these sensors.

Be aware that if the sensors are in a high RF noise environment, increasing sensitivity may also have a negative effect.

In LSC, change the Sensor->Sample Processing->Peak Detect Threshold parameter (highlighted below) for all the sensors, from the default which is 0.01 (well, it will come up as 0.009999999776 in LSC) to 0.003. They could even try 0.002, but I expect it won't make a huge improvement and may risk letting in too much noise and multipath reflections.



Tag Filtering

Default filter settings usually work very well in most situations.

Common requirements for changing filter settings:

- Adjust if needed (max & min height and velocity)
- Make a new filter - this will create a filter with the default settings.
- Recommended Filter Settings – user setting changes from Default Values
- Initial Variance - set to 2. Filter>Limits>Initial Variance
- Low support count seconds set to 10. Filter>Limits>Low support count seconds
- Report Variance set to 2.5. Filter>Limits>Report Variance
- Vertical Speed - set to 0.5 –there usually isn't a whole lot of vertical motion happening!

*****For the new filter to take effect, stop and re-start the platform services in Platform Control.*****

Dataset and Logfile extraction for analysis

To transfer events logs for remote analysis - the first method will result in very big data files to be transferred.

1. Stop the Platform Control Services
2. Copy the top level logging directory (the one that includes the UCell and ULocation files) to a scratch directory somewhere
3. Remove any folders for dates that aren't the one you are interested in
4. Zip the whole lot up
5. Send it via FTP transfer service or similar

6. Start the platform again

If you know roughly what time the event you are searching for was at and/or you know the ID of the tag, you can make a much smaller file by doing the following:

1. In LSC, go to "Review location events"
2. Clear the event buffer (top-right)
3. Go to "Get events"
4. Change the maximum number of events to retrieve to a large number, say 250000
5. Get the relevant events by retrieving by timestamp, optionally filtering on the tag ID(s) you are interested in
6. Now Export (top-right) the events as a .ubievent file

In both cases a copy of the Dataset is also required

To make the Dataset copy

1. Start the Platform Control Services
2. Start the Service Manager and in the Services window on the left, click on All and then click on the Backup button
3. Stop the Platform Control Services
4. Navigate to the Dataset location and zip it (do not use the Backup Dataset button in Platform Control)

NOTE: This file will be very big so you will need to send it by FTP transfer.

Further resources

Detailed online software manual - <https://www.ubisensedimension4.com>

In Service Operation

Back up dataset

It is strongly recommended, once the system is set up, running and calibrated to make a backup of the dataset.

To do this:

1. If not running, Start the Platform Control services
2. start the service manager, click All and then click Backup, once the process is complete, shut down Service Manager
3. Stop the Platform Control services and using file manager
4. Using file manager, browse to the Dataset folder and make a zip file copy clearly naming it so you can restore the dataset if needed.

Update the software and dataset

To update software on an existing system

First start the Platform Services in stand alone mode to backup and rename the active dataset:

1. Start Service Manager and click Backup - the services should all stop and then restart.
2. Close Service Manager and stop the Platform Services, locate the dataset and zip it.
3. Rename the current dataset folder identifying it as a new version.

To update the software, unzip the installation folders and using windows file explorer...

1. Navigate to Servers
2. install UbisenseServers.msi
3. Navigate to Clients
4. install UbisenseApplicationManager.msi
5. install UbisenseServiceManager.msi
6. Open Platform Control
7. browse to the re-named V3.7 Dataset
8. check the box to run in standalone mode
9. start Services

To update the Dataset:

1. Start Service Manager
2. select Install Services on the left of the screen
3. browse to the unzipped installation folder and select the Packages folder (do not open it, just highlight and select)
4. click Select All and then click Install
5. When complete, on the Install Services page, browse to and select the unzipped 3.7 Filter Service folder
6. click Select All and then click Install
7. When complete, in Service Manager select the Manage Services page and you should see all the services running are the new version

To install the new version of Location System Configuration:

1. Start the Application Manager and click on Location Services Controller
2. click on the button at the top "Add shortcut for selected application"

To update Sensor firmware:

1. In Platform Control, stop the services, uncheck the run in standalone mode, make sure the sensors are powered and start the services.
2. When the sensors are fully booted, start LSC
3. Open the Sensor Software / Firmware page
4. in the lower window, select each sensor and one by one click Request Update
5. select all the sensors with a click on the first and shift click on the last and click Reboot
6. when the reboot is complete they should all show running the latest Firmware version.

Fault Finding

Sensors do not boot

There are several things to check:

- Is the PoE network switch connected.
- If set to DHCP, is the DHCP server running and is it awarding IP addresses to the sensors?
- In Platform Control, are the Services Running and is the check box Run In Standalone unchecked?
- In Service Manager, are all the Services running?
- If there is an Error Code indicated by the Sensor LED, see below for full list and description in the Boot Process section.

Boot Process and Sensor Error Codes

LED	Boot Process Step	Failure Modes
BOOT (FIRMWARE)	1. Obtaining an IP address	
	(a) The sensor loads the firmware from non-volatile memory.	
	(b) The firmware reads the sensor's network configuration from non-volatile memory, and decides whether to obtain its IP using DHCP or to use statically-assigned IP settings.	
	(c) The firmware performs DHCP if required.	DHCP Error ●●●●
	(d) The firmware sends ARP probes and announcements in accordance with RFC-5227. If the firmware detects an IP address conflict at any point (e.g. by receiving a conflicting ARP probe) then it will reboot. If a CNC is set for the sensor, it will stay in Pending validation state.	IP address conflict ???
	2. Firmware search for the Configuration Server	
	(a) The firmware reads the search order from non-volatile memory. If the search order has not been configured or has been marked as invalid then a default search order is used.	
	(b) For each search method, the firmware tries to contact the configuration server, performing needed DNS requests. If the firmware receives a valid response, it goes to the next step, marking the network configuration as valid.	Configuration server timeout ●●●●
	3. Obtaining boot configuration and software files	
	(a) The firmware reads the boot configuration server's address from the configuration server's response.	No boot configuration server registered ●●●●
BOOT (SOFTWARE)	(b) The firmware sends a request to the boot configuration server, which replies with the version of the software to run, and the address of a boot file server to obtain the software from. If the boot configuration server has the boot trace enabled, it will report Sensor <MAC> requested configuration... Currently the boot configuration server will always send its own address in response to the configuration request, because the boot configuration server also serves as the single boot file server for the system.	Boot configuration server timeout ●●●● Boot configuration invalid ●●●●
	(c) If the correct version of the software is already "flashed" into non-volatile memory, the firmware loads it.	
	(d) Otherwise the firmware requests the software from the boot file server. If Kernel download timeout the boot file server has the boot trace enabled, it will report messages of the form Sensor <MAC> requested ... and then Sensor <MAC> completed request ... if the download is successful.	File system download timeout ●●●●
	4. Starting the software and software networking	
	(a) The firmware runs the software, telling it whether to use DHCP or the existing static IP information.	
	(b) The software performs DHCP if requested and if so it also sends ARP probes and ARP announcements in accordance with RFC-5227.	
	N.B. If the sensor is using static IP, then no ARP probes or announcements are	

needed because the IP settings have not changed.

LED	Boot Process Step	Failure Modes
INITIALISATION (NO TIMING SIGNAL)	5. Software configuration	
	(a) The software performs a search for the Configuration Server in the same way as the firmware does. It should not time out because it is repeating the task that succeeded when run from firmware	Configuration server timeout (no LED sequence)
	(b) The software reads the address of the location system configuration server from the Core Server's response, and then registers its MAC address, IP address and the location system parameters it needs to run.	Various errors listed in software fatal errors section
	(c) The appropriate cellular location system configuration distribution server responds to the sensor with the required location system parameters, including the IP address of the cellular location sink service to send status and location information to.	
	6. Firmware/software/network configuration	
	(a) The software checks if various diagnostic parameters have been written to the sensor's non-volatile memory. If not, then the sensor calculates these, writes them to the non-volatile memory and reboots.	
	(b) The software checks if there are any pending firmware upgrades. If so, the sensor requests its boot configuration from boot configuration server and verifies that the requested version of firmware is available. The sensor then downloads the firmware from the boot file server, writes it to the non-volatile memory and reboots.	
	(c) The sensor performs the same checks as above with the software.	
	(d) The software checks if there are any pending changes to the sensor's network configuration. If so, the sensor writes the updated network configuration to the non-volatile memory and reboots.	
	7. Sensor hardware and timing initialisation	
RUNNING	(a) The software starts to send periodic status updates. At this stage its status appears as Initializing .	
	(b) The software initialises the rest of the hardware, and waits until it gets a stable timing signal, or until it is generating a stable timing signal if it is a timing source.	
	(c) The sensor's status is now Running . If the sensor_init trace is enabled, the sensor will report Initialisation complete .	
	(d) The sensor starts to send measurements to the relevant effective master sensor for each tag, and it sends calculated locations back to the appropriate cellular location sink server.	
	(e) If the sensor's timing signal subsequently becomes unstable or disappears then its status will be set to No Timing Signal , and the LED	



will go back to the green-orange flashing state.

Firmware Fatal Errors

The firmware stage of the boot sequence can produce a number of fatal errors. When the firmware detects an error, it does not send any trace message, but it flashes its LED in an error sequence:

1. The red LED is lit for about three seconds
2. There is a pause with the LEDs off
3. An error code of four LED colours is emitted, repeated six times with pauses in between
4. The sensor reboots.

The following table lists the meaning of the codes:

RORO		DHCP Error There was an error performing DHCP.
RORG		Configuration server timeout The sensor cannot find the Ubisense configuration server.
ROGR		No boot configuration server registered There is no configuration parameter '_ls_boot_cfg_server' which is automatically added by the boot configuration server.
ROGO		Boot configuration server timeout The sensor failed to retrieve its boot configuration from the boot configuration server.
RGRO		Boot configuration invalid The sensor could not understand the response from the boot configuration server.
RGRG		Kernel download timeout The sensor failed to retrieve the kernel from the boot server given in the boot configuration.
RGOR		File system download timeout The sensor failed to retrieve the file system from the boot server given in the boot configuration.
RGOG		IP conflict The sensor detected an IP address conflict and has rebooted.
OROR		Internal error #1
OROG		Internal error #2
ORGR		Internal error #3
ORGO		Internal error #4
OGRO		Internal error #5
OGRG		Internal error #6
OGOR		Internal error #7
OGOG		Internal error #8
GROR		Internal error #9
GROG		Internal error #10
GRGR		Internal error #11
GRGO		Internal error #12
GORO		Internal error #13
GORG		Internal error #14
GOGR		Internal error #15
GOGO		Internal error #16

Software Fatal Errors

The software can produce several fatal errors. These are indicated by sending a trace message using the standard Ubisense tracing support. These trace messages all start with "<MAC>: fatal:" followed by a descriptive section explaining the nature of the error.

The following errors might be seen if sensors are booting whilst services are being restarted. If the error appears transiently and the sensor recovers after rebooting then there is no cause for concern.

Possible sensor errors

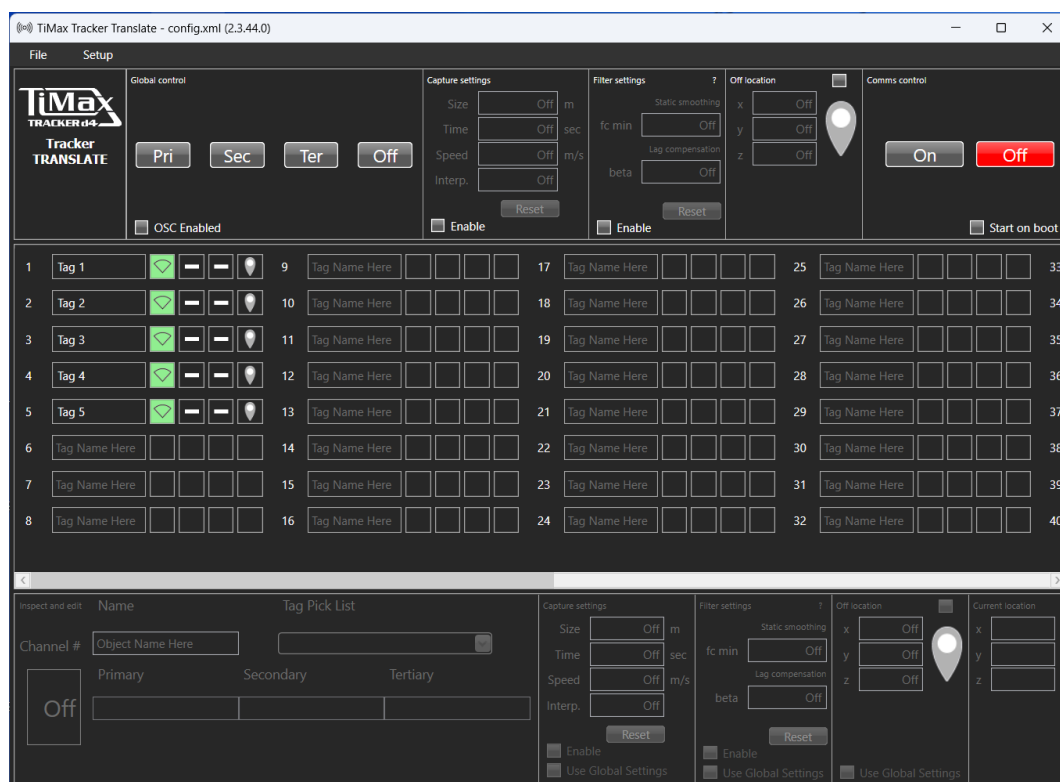
- No Location System Configuration Server registered. Sensor will now reboot.
- Config registration request failed (server at <address>). Sensor will now reboot.
- Config registration request failed (server at <address>) response: MAC <mac> is not known. Sensor will now reboot.
- Config registration request failed (server at <address>) response: incompatible configuration request. Sensor will now reboot.
- Config establish timeout. Sensor will now reboot.
- Failed to retrieve boot configuration from <address> for <software/firmware> upgrade. Sensor will now reboot.
- Failed to download file "<file>" from <address> for <software/firmware> upgrade. Sensor will now reboot.
- Firmware version mismatch: intended version is <version>, but server at <address> reports available version is <version>. Sensor will now reboot.
- Software version mismatch: intended version is <version>, but server at <address> reports available version is <version>. Sensor will now reboot.
- Failed software upgrade: downloaded kernel size mismatch, expected <size> but file is <size>. Sensor will now reboot.
- Unable to perform <software/firmware> upgrade due to missing boot config server parameter in configuration. Sensor will now reboot.

If a fatal error is seen which is not listed above, please report this to Ubisense engineering.

Tracker Translate (New)

Tracker Translate is a data stream format conversion application that receives raw tracking data from the d4 Tracking software and converts it into OSC, PSN and Stage Precision formats for audio and other control purposes.

TiMax Tracker Translate provides a GUI based PC application which converts a raw incoming location data stream from TiMax Tracker d4, BlackTrax or incoming PosiStageNet to an OSC format suitable to control TiMax SoundHub, PosiStageNet for lighting and media controllers, or any other OSC-capable system.



[SCREENSHOT: Tracker Translate main window — full view showing Global Control, Capture Settings, Filter Settings, Off Location and Comms Control panels, with channel list and Inspector section]

Install and Configure Tracker Translate Software

Install the Tracker Translate software on the PC running the d4 Tracking system.

Start the d4 Tracking system with all tags active and place them on stage.

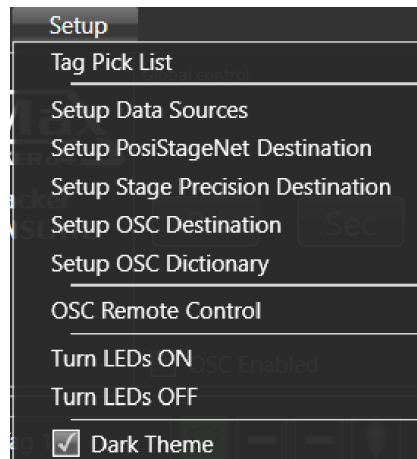
In the Tracker Translate software, start Comms ON and run for a few seconds for Tracker Translate to see the tags and populate the Tag Pick List with all seen tags.

Stop comms and assign tags to performers one by one by dragging from the drop-down pick list.

Start comms and confirm data is flowing. If not, check Firewall settings.

Setup Menu

The Setup menu in the top menu bar provides access to all configuration windows.



[SCREENSHOT: Setup menu open showing full list of menu items]

The full list of options is:

Tag Pick List — view and manage active tags seen by the system

Setup Data Sources — configure incoming tracking data sources

Setup PosiStageNet Destination — configure PSN output destination

Setup Stage Precision Destination — configure Stage Precision output destination

Setup OSC Destination — configure OSC output destinations

Setup OSC Dictionary — manage the OSC Dictionary

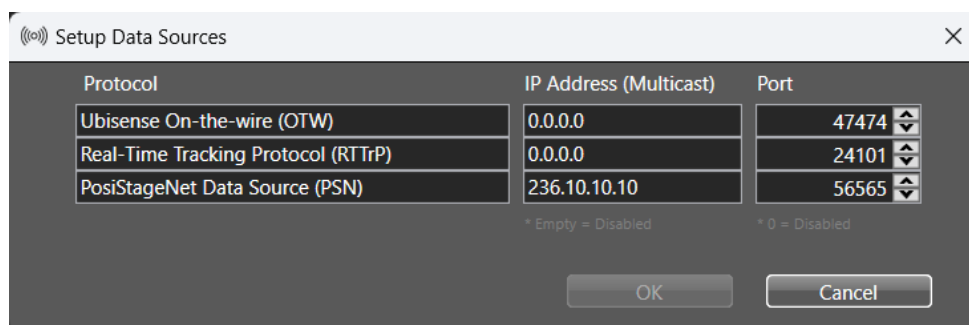
OSC Remote Control — view OSC remote control address and port information

Turn LEDs ON / Turn LEDs OFF — toggle sensor LED status

Dark Theme — toggle the dark UI theme on or off

Setup Data Sources

This is where the Tracker Translate data receiver IP address and port are set. The default IP setting of 0.0.0.0 will configure Tracker Translate to listen on all interfaces. The Ubisense OTW port 47474 should also be set in the TiMax Tracker d4 Location Engine Configuration software.

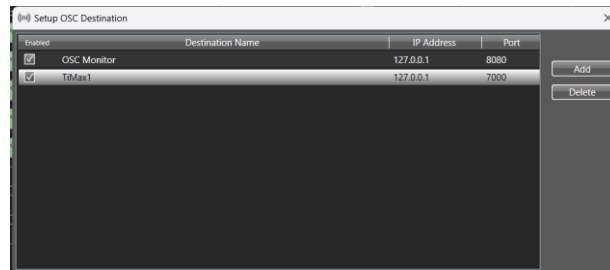


[SCREENSHOT: Setup Interfaces dialog showing Protocol, IP Address and Port columns with Ubisense OTW and Real-Time Tracking Protocol entries]

Setup OSC Destination

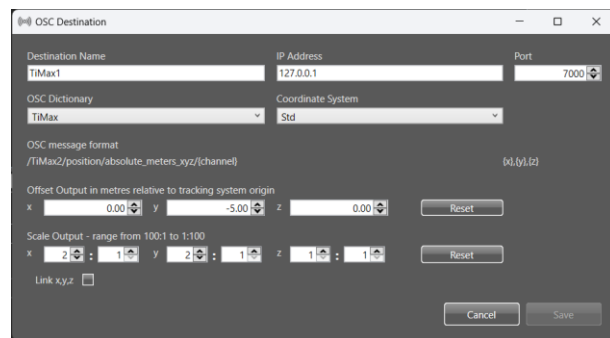
The Setup OSC Destination window lists all configured OSC output destinations. Multiple destinations can be added to facilitate multiframe installations or main/backup configurations.

To open, select **Setup > Setup OSC Destination** from the menu bar.



[SCREENSHOT: Setup OSC Destination window showing destination list with OSC Monitor and TiMax1 entries, Add and Delete buttons]

Click **Add** to create a new destination, or double-click an existing entry to edit it. This opens the OSC Destination editor.



[SCREENSHOT: OSC Destination editor showing Destination Name, IP Address, Port, OSC Dictionary dropdown, Coordinate System dropdown, OSC message format string, Offset Output x/y/z fields and Scale Output ratio controls]

The following parameters are set in the OSC Destination editor:

Destination Name — a label to identify the destination.

IP Address — the IP address of the receiving system (e.g. TiMax SoundHub, d&b DS100, Spacemap Go, L-ISA).

Port — the destination UDP port. This is set automatically when an OSC Dictionary entry is selected.

OSC Dictionary — select a pre-configured OSC message format from the dictionary. The OSC message format string will be populated automatically once a dictionary entry is selected. See the OSC Dictionary section below for details.

Coordinate System — sets the axis orientation of the output data:

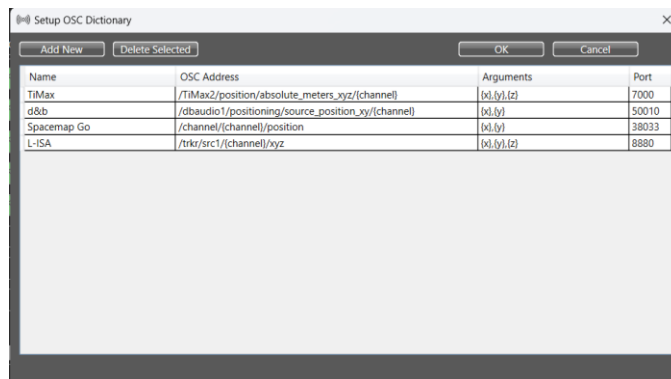
Std — x axis is left to right, y axis is downstage to upstage as viewed from the front of the stage.

Rotated — x axis is upstage to downstage, y axis is left to right. Use this setting for d&b DS100 control. z is always up in both orientations.

OSC Dictionary

The OSC Dictionary is a library of pre-configured OSC message formats for common control systems, eliminating the need to manually enter OSC address strings. It is accessed via **Setup > Setup OSC Dictionary**.

NOTE: if an OSC directory definition is edited, it will not automatically apply to existing OSC clients. To apply, go to the Set Up OSC destinations and from the drop down clear and re-apply the dictionary.



[SCREENSHOT: Setup OSC Dictionary window showing Name, OSC Address, Arguments and Port columns with TiMax, d&b, Spacemap Go and L-ISA entries, plus Add New and Delete Selected buttons]

Pre-configured entries include:

Name	OSC Address	Arguments	Port
TiMax	/TiMax2/position/absolute_meters_xyz/{channel}	{x},{y},{z}	7000
d&b	/dbaudio1/positioning/source_position_xy/{channel}	{x},{y}	50010
Spacemap Go	/channel/{channel}/position	{x},{y}	38033
L-ISA	/trkr/src1/{channel}/xyz	{x},{y},{z}	8880

Custom entries can be added using the **Add New** button, or existing entries removed using **Delete Selected**.

The OSC Dictionary is stored as a JSON file at:

C:\ProgramData\TiMaxTrackerTranslate2\OSC_types.json

This file can be edited directly using any text editor. New entries added in the same format as the existing entries will appear automatically in the OSC Dictionary dropdown for all new OSC destination configurations. This allows sites or integrators to build and maintain a custom library of OSC formats for their specific systems.

The format for each entry is as follows:

```
{
  "name": "System Name",
  "topic": "/osc/address/string/{channel}",
  "body": "{x},{y},{z}",
  "port": 7000
}
```

Where {channel} is replaced at runtime by the assigned channel number, and {x}, {y}, {z} are replaced by the tracked position coordinates. Use {x},{y} for systems that require 2D positioning only.

Origin Offset

The Origin Offset feature allows the tracking coordinate output to be offset in x, y and z relative to the tracking system origin. This is configured per OSC destination in the OSC Destination editor.

Offset Output in metres relative to tracking system origin — enter x, y and z offset values in metres. Click **Reset** to return all values to zero.

This feature provides flexibility for installations where the tracking origin does not align with the control system origin, and is particularly useful for room-to-room or show-to-show transfer of configurations without the need to recalibrate the tracking system.

OSC Scaling

The OSC Scaling feature allows tracking coordinate data to be scaled before transmission, enabling integration with normalised or non-metric control targets. Scale is configured per OSC destination in the OSC Destination editor.

Scale Output — range from 100:1 to 1:100 — set independent scale ratios for x, y and z axes. Check **Link x,y,z** to apply the same scale ratio to all three axes simultaneously. Click **Reset** to return all scale values to 1:1.

For example, a scale of 2:1 will halve the output range, and 1:2 will double it.

Global Control

The Global Control section at the top left of the main window provides overall management of tag activity.

Pri / Sec / Ter / Off buttons provide global selection of Primary, Secondary, Tertiary or Off status for all tags simultaneously. These selections are mutually exclusive and can be controlled manually or via OSC. Buttons flash when clicked or when remotely operated via OSC.

OSC Enabled checkbox activates OSC output globally.

OSC Channel Designation

Each channel of control can be assigned an OSC object number from 1 to 128, set in the **Channel #** field in the Inspector section at the bottom of the main window.

Click on any channel in the main channel list to focus the Inspector. The channel number, object name, and Primary, Secondary and Tertiary tag assignments are all set here.

The screenshot shows the 'Inspector' section of a software interface. It is divided into several panels. The 'Inspect and edit' panel on the left contains a 'Channel #' field with the value '1', a 'Name' field with the value 'Tag 1', and a 'Tag Pick List' dropdown menu. Below these are three buttons labeled 'Primary', 'Secondary', and 'Tertiary'. The 'Capture settings' panel in the middle contains fields for 'Size' (0 m), 'Time' (0 sec), 'Speed' (0.1 m/s), and 'Interp.' (0), along with an 'Enable' checkbox and a 'Use Global Settings' checkbox. The 'Filter settings' panel on the right contains fields for 'Static smoothing' (0.1), 'Lag compensation' (0.05), and 'beta' (0.05), along with an 'Enable' checkbox and a 'Use Global Settings' checkbox. The 'Off location' panel on the far right contains a map icon and three input fields for x, y, and z coordinates, all set to 0. The 'Current location' panel on the far right contains three input fields for x, y, and z coordinates, all set to 0.

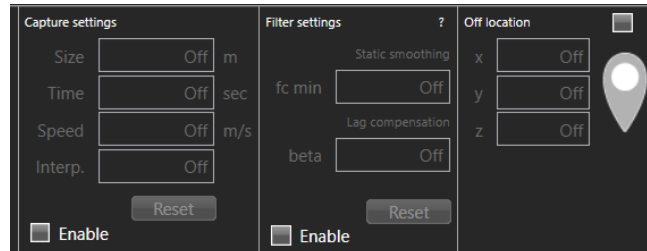
[SCREENSHOT: Inspector section showing Channel #, Name field, Tag Pick List dropdown, Primary/Secondary/Tertiary tag assignment fields]

This allows tracking data from any tag to be directed to any OSC object number on the receiving system, independently of the channel's position in the main window.

Capture Settings

The Capture Settings feature removes positional jitter from the tag location data stream when the tag is stationary, by locking the reported position once the tag has remained within a defined boundary for a set period of time.

Capture settings can be applied globally in the top panel of the main window, or set individually per channel in the Inspector. Check **Use Global Settings** to apply the global values to an individual channel. Check the **Enable** checkbox to activate Capture.



[SCREENSHOT: Capture settings panel showing Size, Time, Speed and Interp. fields with Enable checkbox and Reset button — shown with typical values set]

Size — sets the radius in metres of the capture lock acquisition and breakout boundary. 0 = off, adjustable in 0.1m increments up to 5m. Typical setting 0.5–2m.

Time — sets the capture lock activation delay in seconds. The tag position must remain within the capture boundary for this duration before lock activates. Typical setting 1–2 sec.

Speed — sets the speed in m/s at which the capture boundary follows the tag. Should be set lower than the slowest typical speed of the tag in motion. Typical setting 0.1–0.5 m/s for walking performers.

Interp. — sets the interpolation amount for Snap Release Morph (see below). Range 0–20. A value of 0 gives an immediate release; higher values produce a progressively smoother morph back to the live tag position.

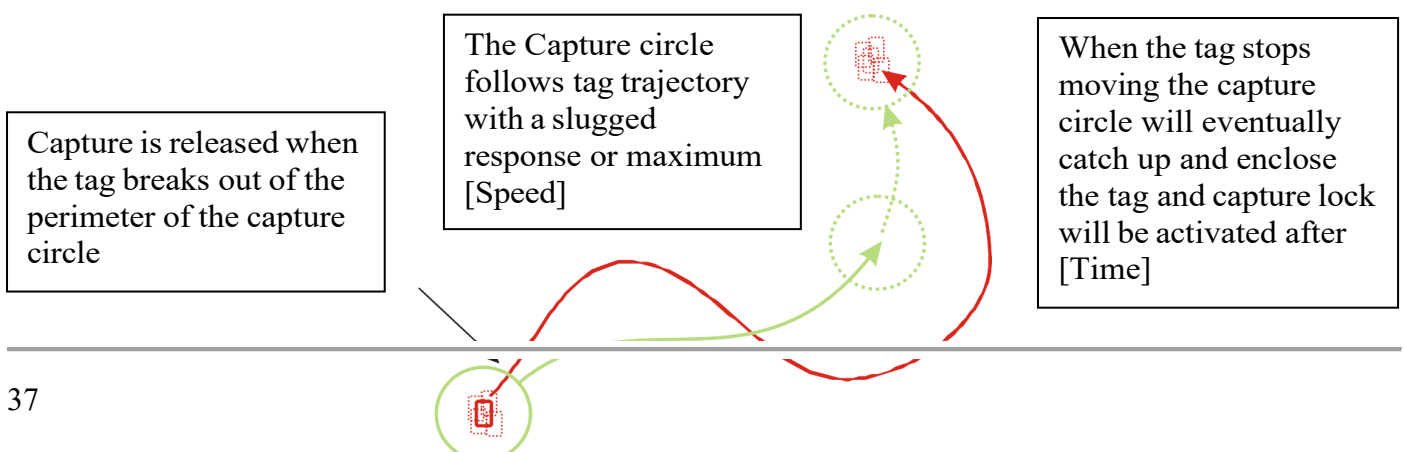
Click **Reset** to return all Capture values to their defaults.

Snap Release Morph

When a tag breaks out of the capture boundary and capture lock is released, the reported position transitions from the captured (frozen) position back to the live tracked position. In previous versions this transition was immediate, which could result in a sudden jump in the output data stream.

The **Interp.** parameter controls the smoothness of this transition. Setting a value greater than 0 causes the position to morph smoothly back to the live tag position on release, eliminating the jerky snap that could occur with fast-moving performers or abrupt changes in direction.

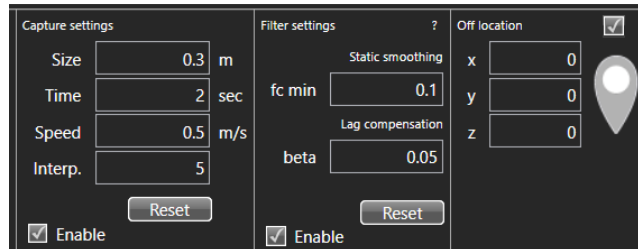
There is a degree of interaction between the Size, Time, Speed and Interp. settings and it is worth experimenting during rehearsal to find the best result for your application.



Filter Settings

The Filter Settings section introduces the **1 Euro Filter**, an adaptive filtering algorithm that provides smooth output at low speeds while maintaining fast, responsive tracking during rapid movement. This replaces the previous fixed rolling average Smoothing control.

Filter settings can be applied globally or set individually per channel in the Inspector. Check **Use Global Settings** to apply the global values to an individual channel. Check the **Enable** checkbox to activate filtering.



[SCREENSHOT: Filter settings panel showing Static smoothing, fc min and beta (Lag compensation) fields with Enable checkbox and Reset button — shown with typical values set]

Static smoothing — sets the amount of smoothing applied when the tag is stationary or moving very slowly. Higher values produce a smoother but less responsive output at low speeds.

fc min — sets the minimum cutoff frequency of the 1 Euro Filter. Lower values produce more smoothing at low speeds. Typical setting 0.1.

Lag compensation (beta) — controls how quickly the filter adapts to increases in tag speed. Higher values reduce lag during fast movement but may introduce more jitter at low speeds. Typical setting 0.05.

Click **Reset** to return all Filter values to their defaults.

The 1 Euro Filter provides a significant improvement over a simple rolling average: rather than adding a fixed latency to the output, it dynamically adjusts the amount of filtering based on the speed of the tag, resulting in smoother output when stationary and more responsive tracking when in motion.

Off Location

The Off Location sets the x, y, z coordinates to which a tag's reported position will move when that channel is switched to Off. If no coordinates are set the tag will remain at its last known position.

Off Location can be set globally or per channel in the Inspector. Check **Use Global Settings** to use the global Off Location for an individual channel.

Comms Control

The Comms Control section provides manual means to start and stop OSC or PosiStageNet communications to the connected control system. Check **Start on boot** to automatically start communications when Tracker Translate launches.

The **On** button starts the data stream and the **Off** button stops it. The active button is highlighted.

Assigning Tags to Control OSC Data Streams

From the top menu bar, select **Setup > Tag Pick List**. The list is automatically populated with all active tags seen by TTd4.

Tags can be dragged directly from the Tag Pick List to a channel Primary, Secondary or Tertiary slot in the main channel list, or assigned in the Inspector. Each channel displays activity and QoS indicators for the Pri/Sec/Ter tags, refreshing at 0.5Hz. A dash indicates no tag is assigned.

Click on a Tag Name or channel number to display and edit channel settings in the Inspector.

Tags and associated settings can also be configured using the **File > Export to CSV / Import from CSV** feature, where the setup workflow can be accelerated using spreadsheet editing. Export to CSV, open in a spreadsheet application, edit the data entries, save as CSV and re-import to Tracker Translate.

Remote Control of Tracker Translate

Global or per-tag switching between Primary, Secondary and Tertiary tag selection can be remote controlled using OSC messaging to Tracker Translate.

OSC control messages sent to the RC port should be in the format:

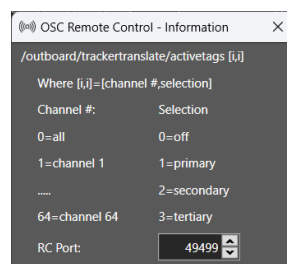
`/outboard/trackertranslate/activetags [i,i]`

Where the first integer is the channel number and the second integer sets the desired status:

- 0 = off
- 1 = primary
- 2 = secondary
- 3 = tertiary

For example: `/outboard/trackertranslate/activetags 0 1` sets all channels to primary tag active.

The RC Port is shown in the OSC Remote Control information window, accessible from **Setup > OSC Remote Control**. Default RC port is 49499.



[SCREENSHOT: OSC Remote Control information window showing address format, channel/selection reference table and RC Port number]

Turn Sensor LEDs On or Off

This command turns the sensor LEDs on or off, accessed via **Setup > Turn LEDs ON** or **Setup > Turn LEDs OFF**.

The command runs an executable that communicates with the tracking system to set the LED status. In order to complete the command the sensors must be rebooted — this can be done from within Location Engine Configuration or by powering the sensors off and on.

The sensor LEDs will be illuminated during the boot-up process and will extinguish once boot-up is complete, allowing boot failure faults to be identified.

Configure TiMax Software for tracking

Go to View / OSC window in the TiMax Soundhub control software.

Start Read to see incoming OSC data stream

Stop Read and select messages tag by tag and map to TiMax controls (PanSpace Point x,y,z), channel number and coordinates in Meters

Go to the PanSpace Spatialisation window and set tracking on (T) for each tracked channel

Appendix 1 - Sensors



TTd4 ultra-wideband (UWB) sensors are precision measurement devices, containing an array of antennas and ultra-wideband radio receivers. The sensors detect UWB pulses from the tags, allowing the location system to find the tag positions with high accuracy.

Sensors are directional which means they have a high level of rejection of noise and other signals outside of their field of vision. Orientation of the sensor with respect to the tracked area is important.

Sensors are PoE powered and require around 15 watts. A timing signal is distributed around the sensor array on unused cores on the Cat5 cable. See Timing Hub section for details.

LEDs on the front of the sensor; top left indicates status and error codes (see Boot Process section) and bottom right indicates Network connection speed and activity.

Sensor Mounting

Sensors must be mounted with the spirit level at the bottom of the case level and the label text the right way up. The center line of the field of vision projects forward perpendicular to the sensor case from the white spot just below the center-line on the front.

Best Practice

The sensor cable should be pulled leaving a reasonable service loop of around 2 to 3 meters to allow repositioning of the sensor if required... for example if a lighting fixture is moved or added to a position that impairs the sensor performance. This is quite common.

Sensors should be mounted in a position where they are unlikely to be moved or inadvertently knocked out of position.

Make sure that sensors are mounted onto a solid support that will not move or change position.

Choose sensor positions that will not have line of sight to the stage temporarily blocked by stage props or scenery.

Mount sensors in places where as much of the tracked (stage) area as possible within its field of vision

Evaluate potential sensor mounting positions in terms of offering access for repositioning the sensor if required.

Angle sensors such that their near-field vision is clear of any RF reflective surfaces, metal objects, walls, scenery. No metal or RF reflective objects or material in the sensor field of vision within minimum 3 meters from the sensor

Position sensors at least 3 meters away from any RF / WiFi transmitter or other potential source of RF interference.

Vertical position and angle

Sensor mounting height is not critical to system operation.

Experience has shown that mounting sensors at a height of 3-5 meters works well and achieves a good balance between proximity and body blocking issues, that is to say the sensors can see over the heads of performers between the sensor and the tracked character, while not being too far away.

Sensors mounted high should be positioned and angled down to avoid multipath reflections from overhead stage lights and fly bars and so as to see directly below.

Make sure the sensor is mounted forward of and metal or RF reflective objects below.

Horizontal position and angle

Position each sensor to see as much of the tracked

(stage) area as possible.

Find locations for sensors that offer a full unobstructed view of the stage from as many different points of view or angles as possible.

Mount and angle sensors to be forward of any RF reflective objects or materials.

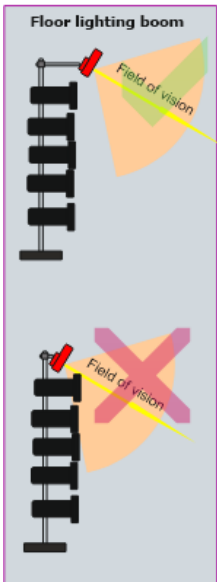
Angle sensors such that their field of vision excludes any RF transmitters in the near and mid field. Look out for 5GzWifi and comms system transmitters.

Mount the sensor forward of any stage lighting fixtures so the sensor has a clear unobstructed view of the stage or performance area.

Performers and other tracked objects near to and below the sensor will be clearly seen with no interference for best possible results.

Metallic objects in the sensors field of vision, particularly in the near field could result in multipath reflections and severe impact on tracking performance.

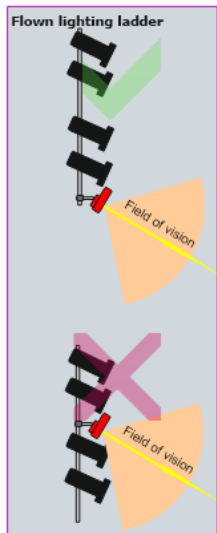
Tags below and near the sensor may not be seen due to severe loss of signal integrity at the antenna because of multiple arrivals.



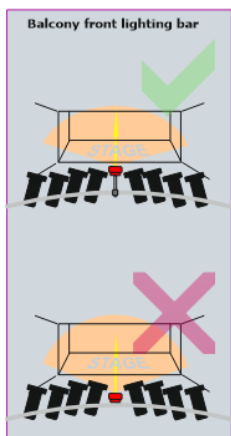
Usually a good choice for side stage sensor positions.

Important to make sure that the structure is firmly fixed does not move.

Use a boom to mount the sensor forward of adjacent lighting fixtures.



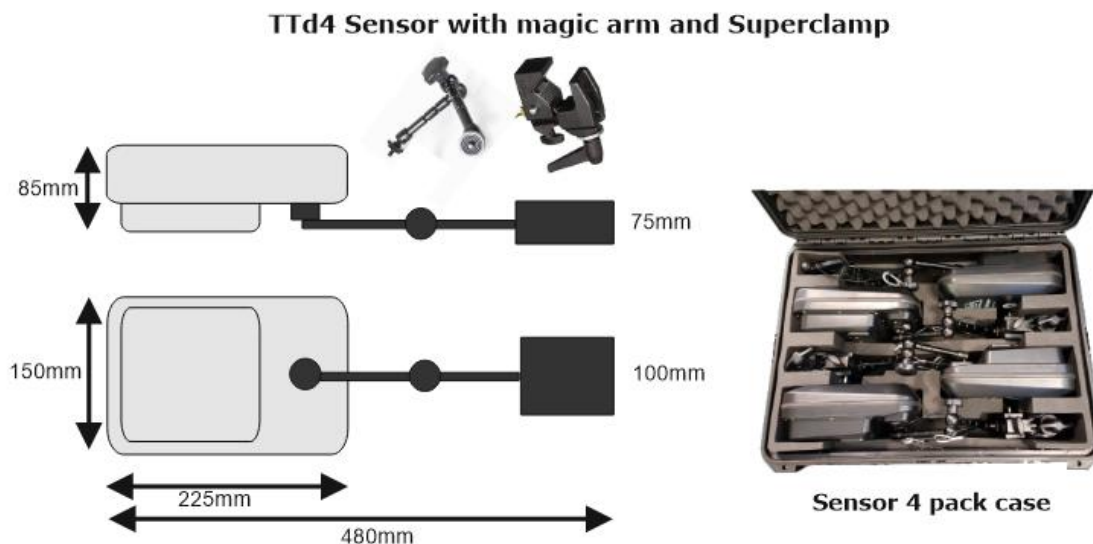
Mounting positions below lighting fixtures usually offer a good choice for a clear view of the stage while minimising nearfield reflections from adjacent lighting fixtures.



Great position for uninterrupted full stage view either from either a single sensor near the center, or a pair of sensors left and right.

Find uncluttered sections of the bar or mount the sensor forward of other fixtures.

Be sure to survey for wireless transmitters near or in the field of vision.



Sensor Connection

Sensors are provided with an Ethercon Rj45 connector which carries PoE power, network data and a timing signals. Sensors are synchronised with each other to within a fraction of a nanosecond using signals sent between them on spare lines of the Ethernet cables, network data and timing signals are combined in the passive Timing Hub.

Sensors can run without any synchronisation in an AoA-only positioning mode.

Sensor LEDs

The top tri-colour LED indicates boot status and will repeatedly flash a four colour sequence as an error code if it fails to boot. Refer to the Boot Process document for details.

The 3 LEDs at the bottom are Network Status LEDs

Top LED (Red). If this LED is on, the Ethernet link has been established.

Middle LED (Green) - on indicates activity on the Ethernet link.

Bottom LED (Yellow) - shows the speed of the Ethernet link.

If the LED is off, the speed is 10 Mbps

If the LED is on, the speed is 100 Mbps

Sensor Specifications

Power Supply - Power-over-ethernet IEEE 802.3af compatible

Temperature Range - -40° to 65° (-40° to 149°)

Humidity - 0 to 95% non-condensing

Protection levels IP30

Case - Black UV Stabilized Ip30

Radio Frequency - Ultra-wideband channel 6 - 7GHz

Connections - 1 x Ethercon

Certifications - US: FCC Part 15 FCC ID SEASENSOR30, Canada: RSS-GEN, RSS-210, RSS-220; IC: 8673A-SENSOR30, EU: CE

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Appendix 2 - Timing Distribution Hub

Passive Timing Hub



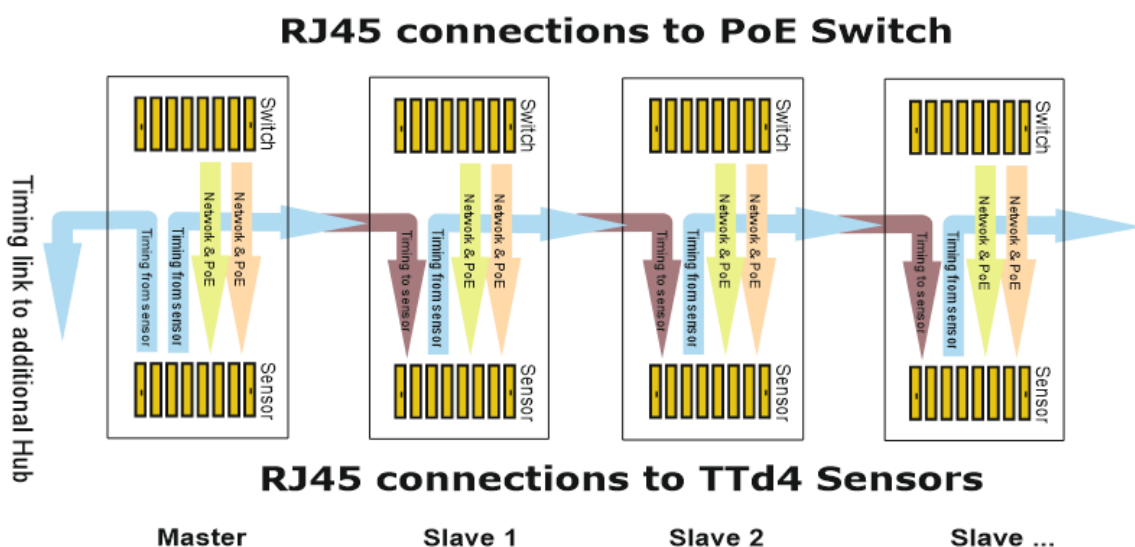
In order to provide a single cat5 cable run to each sensor from a single point, the passive timing hub provides the system with a means of combining the network and timing signals needed by the sensor and passing the timing signals from the master sensor along the timing chain to downstream sensors.

The timing signal is necessary for Time Difference of Arrival operation.

If multiple hubs are required, the timing signal can be bridged between them, if this is not possible, each hub can run its own timing master sensor.

Connections

It is important that the connections in the Hub are sequential, if there are less than 8 sensors connected to the Hub, there must be no empty Etercon connections between the Master and the highest number slave so if there are 3 sensors they must be connected to Master, Slave 1, Slave 2. If the connectors are not sequential then the timing signal chain will not be complete.



The first sensor in the timing chain is set in software to Timing master

Dual hub configuration

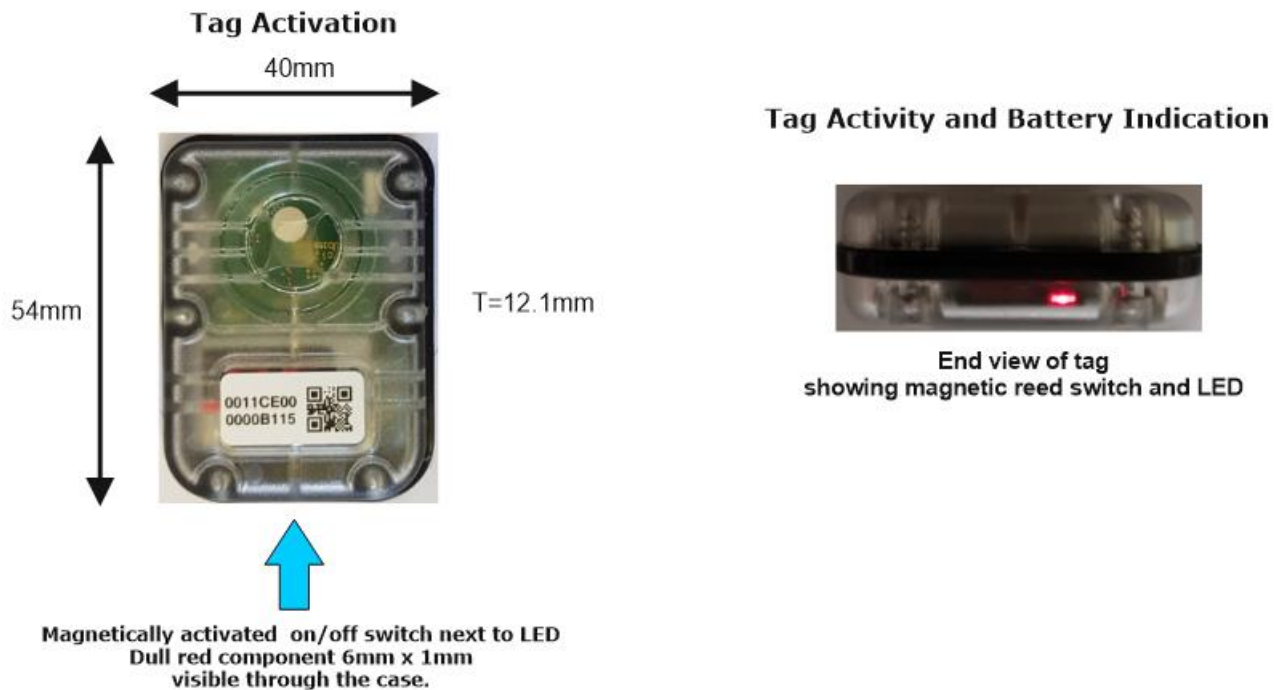
There are 2 ways to configure dual hubs:

All sensors running in a single timing tree - the timing signal link between the two hubs makes this happen.... the sensors on the 'A' hub have one sensor configured as the master (this MUST be connected to the Master position either hub) and the other 7 sensors are configured as slaves. The master sends the timing signal to the 'B' hub on the timing link cable. The 'B' hub sensors are ALL configured as slaves including the sensor connected to the Master connector... the two groups of sensors will then be synchronised.

It is also possible to configure a dual hub system with 2 separate timing trees, in this case the 2 groups of sensors will not be able determine TDoA data between any sensor on the 'A' timing tree and any sensor on the 'B' timing tree, they will share AoA information.. the result may be slightly reduced tracking performance in overlapped coverage areas where both 'A' and 'B' sensors can see the tag.

Appendix 3 - Tags

TTd4 Tags are supplied factory programmed with their update rate and while active will continue to transmit location pulses. Tags are activated and de-activated using a magnet. Tags will run for several months (depends on update rate) and indicate low battery status when the battery is discharged by around 90%



To activate the tag hold a magnet where indicated for 5 seconds, the LED will start blinking to indicate tag active.

To turn off, hold a magnet here for 5 seconds, when the LED goes solid red remove the magnet and the LED will extinguish.

Blinking LED indicates tag on and running

At the standard 10Hz update rate the battery life expectancy for 24/7 operation is around 3 months.



Continuous blinking LED indicates battery OK.



Interrupted blinking LED indicates battery change due.

The tag will continue operating for 2-3 days.

From tag turn on it takes 2-3 min to go into interrupted blink mode if the battery voltage is less than 3v.

Tag Battery

EF651625 - Battery, LTC-7PN, 3.6 V, Lithium Thionyl Chloride, 750 mAh

<https://uk.farnell.com/eve/ef651625/battery-lithium-3-6vprismatic/dp/1973588?st=EVE%20LiThCl%20battery>.

TTd4 Tag Specifications

Dimensions: 54mm x 40mm x 14mm (2.1" x 1.6" x 0.6")

Weight: 28g (1.0 oz.)

Temperature: -40°C to 85°C (-40°F to 185°F)

Humidity: 0 to 95%, non-condensing

Enclosure: UV-stabilised polycarbonate enclosure, silicone gasket V-0 flammability-rated Ingress protection to IP67 and IP69K

Update rate: Standard 10/20/50Hz, other custom frequencies are available

Peripherals: Activity feedback LED Magnetic reed switch (operable through enclosure) Motion detector

Radio frequencies: Ultra-wideband channel: 6 - 7GHz Telemetry channel (optional): Narrow-band 2.4GHz

Certifications: US: FCC Part 15 FCC ID SEAMOD31

EU: CE

Canada: RSS-Gen, RSS-102, RSS-210, RSS-220 Industry Canada ID 8673A-MOD31

Power supply: Replaceable lithium thionyl chloride battery (LTC-7PN)

Reliability: Estimated Mean-Time-Before-Failure (MTBF): 25 years

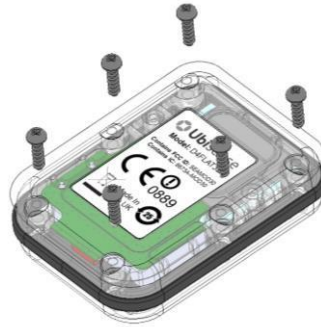
Battery Replacement

Beware not to short battery contacts as this could cause fire or explosion

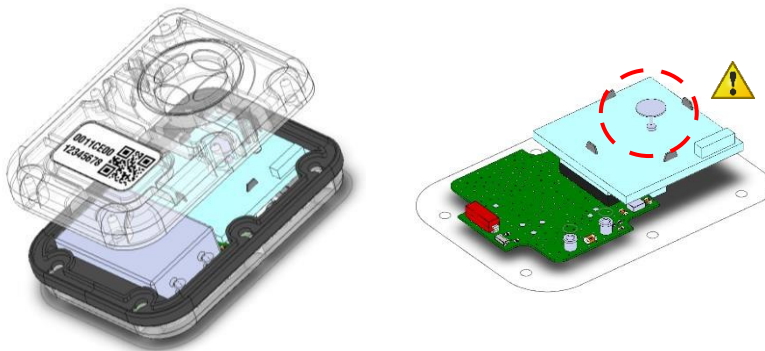
Opening the Enclosure

The first step is to loosen and remove the six screws that hold the enclosure together. You should use a PZ1 driver, with as narrow a diameter as possible; please refer to Appendix B for a suggested part.

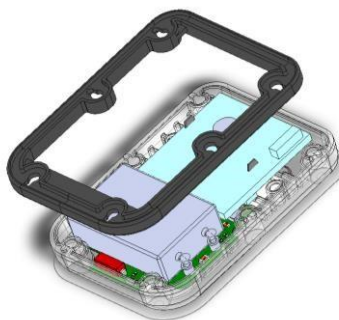
Remove the six screws and place to one side:



Turn the enclosure over and remove the front part of the enclosure, being careful not to catch the antenna (highlighted in the red circle) that is located underneath the Ubisense logo on the enclosure:



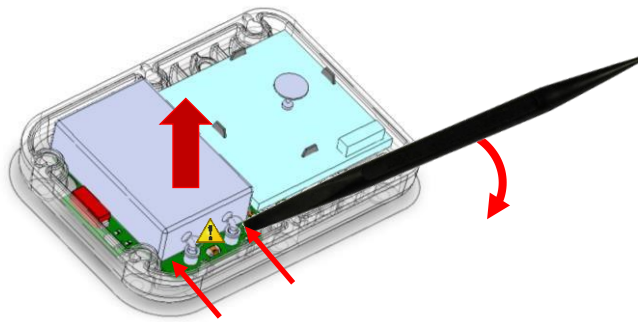
Optionally you can also remove the gasket, placing this to one side; this makes it easier to access the underside of the battery in the next step:



The battery is now exposed and ready for removal from the two connectors.

Removing the Old Battery

Two circular connectors hold the battery terminal leads in place:

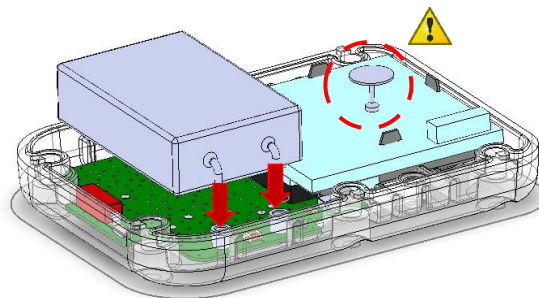


The terminals are sprung-loaded, ensuring a good electrical connection even when subjecting the tag to shock or vibration. Use a non-conductive plastic screwdriver or “spudger” to ease the leads out carefully and release the battery by pushing the sharp end under the edge of the battery and then applying light leverage against the edge of the enclosure. **Take care not to damage the small component that is located between the terminals; ideally try to apply force to each of the corners in turn, carefully lifting the battery away from the PCB.**

Fitting the New Battery

You should be using one of the Ubisense spare parts (part code **FLATBAT**), or have modified an off-the-shelf battery according to the instructions provided in Appendix B.

To fit the new battery, align the two leads with the connectors on the PCB and gently push the battery down until the bottom of the battery is in contact with the PCB:



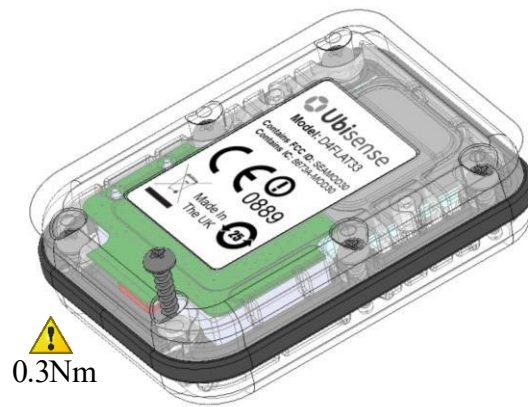
Take care not to accidentally bend either of the battery leads while pushing it down into place. **You should also avoid contact with the antenna (highlighted in the red circle) to avoid risk of bending or snapping it.**

Resealing the Enclosure

Inspect both sides of the gasket and ensure there are no rips or tears. Blow any dust or other contaminants from each of the surfaces. Replace the gasket back onto the enclosure, around the battery, aligning the openings of the gasket with the screw bosses; the gasket is reflectively symmetric, so it does not matter which way around you fit it as long as it aligns with the bosses in the enclosure.

Check the exposed surface does not have any dust or other contaminants present on it and then replace the rear half of the enclosure, ensuring that the screw bosses align with the gasket and front-half of the enclosure. If there is any dust present, it may be blown away, ideally using compressed air.

Using a good-quality torque driver, such as the ones shown in Appendix B, reseal the enclosure:



Replace each of the screws in turn into the openings in the back of the enclosure and tighten them to a torque of **0.3Nm** (30cNm); take care not to over-tighten them to avoid any damage to the enclosure.

Once you have tightened all six screws, you may optionally use a set of callipers to verify the enclosure is providing the correct compression to the gasket: **the overall thickness of the assembled enclosure should be 14mm (within a tolerance of +/-0.05mm) across the full length. If any of the areas near a screw are thicker than this, verify the screw at that position is at the correct torque.**

Modifying an off the shelf battery

The **D4FLAT33** tag uses a customised version of the **EVE EF651625** prismatic cell. The Ubisense part code for a replacement battery is **FLATBAT**.

When bought “off-the-shelf”, this battery is a four-terminal device:



To prepare this battery for use with the **D4FLAT33** tag, you will need to remove the two spot-welded support pins and trim two formed-contacts to the correct length.

Removing the Spot-Welded Support Pins

To remove the two spot-welded support pins you will need a pair of needle-nosed pliers



Safety Note: Ensure you are wearing eye protection and that you are working away from other people, as these terminals can ping-off the body of the battery in an unpredictable way!

Use the pliers to grip along the pin and then gently twist around the weld to snap it:



The contact should lift away from the battery. Note that both contacts are at the same voltage (ground), so it does not matter if you accidentally touch the neighbouring contact during this operation.

Trimming the Formed Terminals



Safety Note: The other two contacts supply the voltage from the battery; you must take care not to accidentally short them together as the battery is capable of supplying quite high currents!

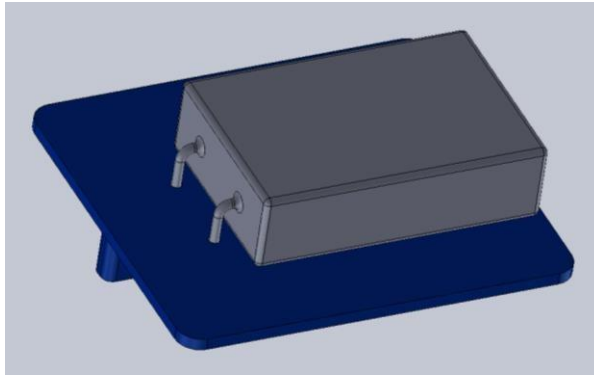
We recommend the use of a simple jig to assist with the removal of the battery contacts. If you have access to a 3D printer we can supply the STL data to allow you to print this for yourself, or we can supply a printed version for a small fee.

This picture shows the underside of the jig:

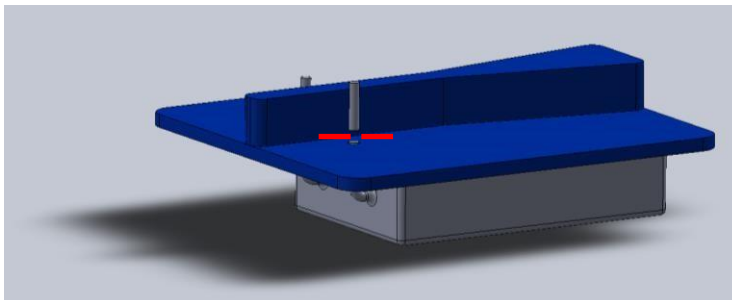


The thickness of the body of the jig defines the length of the battery leads; do not apply any scaling when printing the part! The rib helps prevent accidental shorting of the battery leads during cropping.

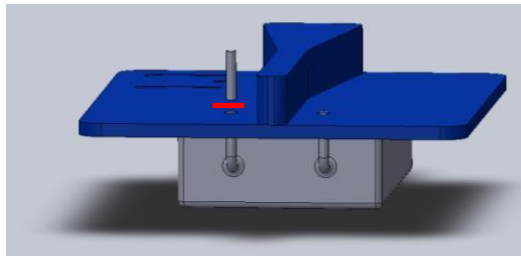
Push the battery leads through the jig from the *opposite* side to the one with the rib, taking care not to bend the leads or stab your fingers:



Turn the jig over, with the battery in place and keeping it pushed flush to the flat surface. Using the sidecutters, trim the battery contact flush with the underside of the jig:



When trimming the battery lead keep the cutters below the top surface of the rib to minimise the risk of accidentally shorting the two battery leads. Repeat the process for the second battery lead:



Discard the unused battery contacts carefully. **You now have a suitable battery for the replacement procedure described in the main body of this document.**

Out Takes

These are cuts from the above that may be re-included in the above or trashed.

The TiMax TrackerD4 Location Engine is a comprehensive package including sensor firmware and server-based software components required to configure, coordinate and manage the TiMax TrackerD4 Precision StageTracking system. This includes:

- Code running on the sensors
- A set of services that run on a networked Linux or Windows server or servers
- A set of Windows-based GUI configuration tools

Scalability and real-time performance lie at the core of the TiMax TrackerD4 architecture, allowing users to deploy sensor systems that scale from small installations running on a single machine through to large sites with several servers and thousands of sensors and tags.

- Management of initial sensor installation and configuration workflow
- Secure centralized management of configuration data for the sensor network
- Real-time coordination of the sensor network to share tag measurements between sensors
- Bayesian filtering of tag measurements to generate accurate tag location data
- Bulk storage and retrieval of measurement and location data for audit and review
- Health monitoring of the sensor network to support proactive maintenance

Please refer to the software manual for detailed instructions.